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AVIATION AND AIRCRAFT JOURNAL

Sablatnig Cabin Airplane Equipped with Skis

VOLUME X
Number 13

Four Dollars a Year

SPECIAL FEATURES

MOBILIZING AT LANGLEY FIELD FOR BOMBING TESTS
"WHO'S WHO IN AMERICAN AERONAUTICS"
ARMY AND NAVY DEVELOPMENT OF AERO ENGINES
"AVIATION" EDITOR'S SUCCESS IN NAVY COMPETITION
COMMERCIAL AVIATION IN GERMANY

THE GARDNER, MOFFAT CO., INC.
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AVIATION
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Vol. X MARCH 28, 1921 No 13

German Methods of Stress Analysis

ONE of the German *Technische Berichte*, Loads and Calculations of Army Airplanes, recently translated by the office of Naval Intelligence makes interesting reading. Stress analysis methods do not vary much in any service be it American, English, French or German; but each service has its own well defined methods and makes use of certain assumptions, partly empirical in character, which it is valuable to study.

Speaking of sand tests, Mr. Stetmachowski, the author of the German report, is of the opinion that while methods of calculation have greatly improved, it is not possible owing to lack of trained workers and dependable structural materials to do away with sand loading, and further that even if the strength of the machine has been carefully calculated, it should still be required that its structural strength be demonstrated by a sand load. This opinion was given toward the close of the war. It is not an unfair inference, that if this engineer were aware of the even more careful methods now prevailing, and of the great accumulation of data available on materials, he might sanction the disuse of sand testing.

The various cases for which calculations are made by the Germans appear to be: A.—Taking off (or large angle of incidence), B.—Gliding at 30 deg. to the horizontal, C.—Nearly vertical dive, D.—Upside down flying.

Cases A, C, and D correspond to American practice. Case B approximates the American method of calculating stresses for high speed, as far as the angle of incidence is concerned, but is perhaps a better physical representation of the condition to be allowed for. We do not seem to have in American practice a clear idea of what the high speed conditions represent, having no clear cut theory as applied in case A (recovery after a dive at high angle of incidence.) A severe load at small angle of incidence might well be imposed by putting an airplane rapidly into a 30 deg. dive, and hence the German form of small angle of incidence condition may be said to have a logical basis.

Two distinct types of load factors are used, one of load factors in stress analysis, one of load factors in sand testing. The author states quite correctly that the calculations of the strength of individual members of the wing truss do not exactly coincide with the results of the actual load test because of the added stiffness of ribs and fabric on test loading. Accordingly the load factors in sand testing are made larger than for stress calculations. A comparison between calculated strength and actual breaking strength shows that the differences never amount to 30 per cent, however. These differences decrease as the size of the airplane increases.

The load factors as apparently used by the German Air Service are surprisingly low. Machines are divided into five groups, (1) over 11,000 lb. (large bombers) (2) 5500-11,000 lb. (bombers) (3) 550-9000 lb. (machines with some fighting value) (4) 2600-5500 lb. (fighting, reconnaissance) (5) less than 2600 lb. (single seater fighters). For case A the calculated load factors are 3.5, 4.0, 4.5, 4.5 and 5.0, which is considerably below our values. Perhaps the Germans had good reasons for such low values. Certain other points of this report, such as the loads per square foot on the tail surfaces, substantiate American practice.

Installation of Airplane Engines

A RECENT paper by A. J. Rowledge before the Royal Aeronautical Society describes the installation of the Napier "Lion" on four or five English machines. The paper is not valuable by its novelty, but is important because it lays down a number of definite rules fairly well-known to designers yet not always followed, and its conclusions based on wide and accurate experience will form a very reliable guide for the installation of an airplane engine. Some of these conclusions are well worth enumerating.

For ignition, two independent systems and two plugs in each cylinder are recommended. Throttle and mixture controls should be interconnected. All engine controls should be rods and levers instead of wires. Carburetor intake should be outside. Exhaust pipes should be cooled and supported. Magnetos should be fireproof. Tanks should be separated from the engine by fireproof bulkheads. Sufficient cooling should be provided for the worst condition, and shutters fitted to reduce cooling area when required. Engine driven pumps with pumps duplicated and hand pumps to feed to the gravity tank are recommended.

Airplanes Versus Airships

IT seems to be the unfortunate style among certain airplane enthusiasts to "knock" the airship, and vice versa. If such controversy served any purpose of real enlightenment it would be worth while, but usually the adherent of one side disdains any real study of the other and the discussion centers around mere interesting fancies.

The latest example of this kind is a sweeping condemnation of the commercial airship, originating in one of the Dutch magazines and given considerable publicity. Its principal basis seem to be, first, that an airship requires large expenditures of ballast like a free balloon, and second, that one-third of its lift disappears at 10,000 ft. altitude. As to the first statement, the facts are that a modern high power dirigible uses hardly any ballast at all, as practically all temperature variations are handled by elevator control. The second statement is of course correct in theory. But it should be considered that for any special case where it is necessary to travel high, the procedure would be to design the ship to carry full load at the required altitude, which is very different from taking to a high altitude an airship designed for practically sea level use.

When the heavier-than-air and lighter-than-air advocates stop trying to trip each other and realize that the two main types of aircraft are mutually supplementary, and are not in anyway competitors, it will save time for all concerned.

Army and Navy Development of Aero Engines

Development of certain types of engines by the Army and Navy Air Services has been recently approved by the Secretary of War and the Secretary of the Navy upon recommendation of the Aeronautical Board.

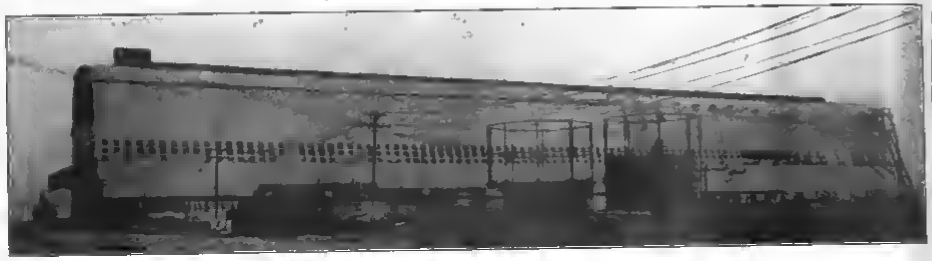
These engines have been arranged into three groups, namely:

(a) Engines, the development and use of which are of mutual interest to the Army Air Service and to the Navy Air Service.

(b) Engines, the development and use of which are primarily of interest to the Army Air Service.

(c) Engines, the development and use of which are of interest primarily to the Navy Air Service.

In thus dividing these engines into three classes, it should be noted that class (b) and class (c) will, by the process of elimination in a great many cases, be merged with class (a).



THE LARGE HANGAR FOR RIGID AIRSHIPS AT THE NAVAL AIR STATION, CAPE MAY, N. J.

It is believed that engines now placed in class (b) will never be entirely without interest and value to the Navy Air Service, nor will engines for the present placed in class (c) be entirely without interest and value to the Army Air Service. The list of engines by class is as follows:

Class (a) Of Mutual Interest to the Army and Navy Air Services

50-60 HP

An engine of this power is available but further development of this type of engine has been assigned to the Navy Department.

350 HP. AIR COOLED RADIAL ENGINE

This engine is placed in this class on account of the maneuverability that can be given to an aircraft equipped with it, reduction in area of vulnerable parts, and a wide range of atmospheric temperature in which it will probably be capable of operating. The development of this engine is now in hand under Army cognizance.

550 HP. WATER-COOLED ENGINE

For medium weight heavier-than-air craft. An engine of this type is in process of development in commercial hands. Tests are being conducted under Army cognizance and modifications are being recommended by the Army Air Service.

700 HP. "W" TYPE WATER-COOLED ENGINE

For heavier-than-air craft of large size. This type of engine is in process of development under Army cognizance.

1000 HP. "W" TYPE WATER-COOLED ENGINE

For aircraft of heavier-than-air type of extremely great size, now in process of design by the Army Air Service.

ENGINE TO OPERATE ON HEAVY OIL FUEL, PROBABLY ABOUT 500 HP.

The development of this engine is of mutual interest, in view of the existing fuel situation and in view of the desirability of eliminating, to as great an extent as possible, fire hazards existing in the use of present type aviation (airplane) engine fuels. The development of an engine of this type has been undertaken under Navy cognizance.

160 HP. 6-CYLINDER WATER COOLED ENGINE

This engine is being developed under Army cognizance as an engine for installation in aircraft used in training. The development of this engine and of the engine noted under class (b) of approximately the same hp. but of radically different type is being carried on with a view to determining which of the two types is the more suitable for a standard engine for this purpose.

300 HP CANNON ENGINE

This engine is being developed under Army cognizance, for installation in an aircraft where it is desirable to have a gun of greater than small arms calibre capable of firing directly ahead through the propeller hub.

350 HP TO 375 HP WATER-COOLED ENGINE

This engine is to be developed and has been a subject of study by the Air Service of the Army for use in installation in pursuit airplane. The engine contemplated is primarily of the highest performance type, will be highly stressed, of very light weight, and probably of only moderate durability, since the nature of the service to be performed has to justify a design of these characteristics.

300-400 HP 6-CYLINDER WATER-COOLED ENGINE

Engines of this type are being developed under Navy cognizance for installation in rigid airships, or in large non-rigid airships.

Class (b) Engines Primarily of Interest to the Army Air Service

140 to 160 HP. AIR-COOLED ENGINE

This engine is being developed under Army cognizance as an engine for installation in aircraft used in training.

Class (c) Engines of Primary Interest to the Navy Air Service

200 to 230 HP. RADIAL AIR-COOLED ENGINE

This engine is being developed under Navy cognizance as a step toward the development of a durable, relatively cheap engine for training purposes, or for small shipboard aircraft. It should be noted that this engine is of a greater power than either of the engines being developed under class (a) for training purposes and of less power than the 350 hp. air cooled engine being developed under class (a). Its development is desirable for training purposes since the requirements of the Naval Air Service are such that greater powers are needed in aircraft for training than are required by the Army Air Service. Likewise, it is desirable to have available an engine of domestic manufacture of about this power corresponding with certain well-known engines of foreign manufacture, for use in small shipboard and other type aircraft.

250 to 275 HP. ENGINE

This engine is to be developed for use in a twin-engined airplane or seaplane designed as a torpedo carrier, bomber or spotting machine. It should be noted that the total power of these engines as contemplated for a twin-engined installation is approximately equal to that of the 550 hp. engine noted under class (a), but the development of the smaller engine appears to be desirable from considerations of maneuverability and ease of installation in Naval aircraft designed as torpedo carriers.

650 TO 750 HP WATER-COOLED ENGINE

The development of a larger type of engine for rigid airships appears to be desirable, in view of the increase in size of this type of aircraft, with a view to reducing complication of power plant to the greatest extent practicable without undue concentration of weights, and at present, it appears that 650 to 750 hp. represents the maximum power and weight that was practicable to concentrate in a single unit for this purpose. To be developed by the Navy Department.

STEAM ENGINES

The development of the steam engine is to be continued at once, and worked to a definite conclusion as rapidly as possible.

GEARED ENGINES

The Navy is now engaged in the development of the geared engine for use in its aircraft.

It is probable that the development of both air-cooled and water-cooled engines of the power noted will be desirable. It will be seen the continuance of existing development work and the inception of other projects covering an extremely wide field of engines, both as to power and as to type, has been determined upon. Such wide and detailed development is extremely necessary at this time in order that the availability, or lack of engines of a given type, may not prevent the development of types of aircraft of the greatest utility.

The importance and possible value of the development of an internal combustion engine of turbine type is being followed by the War and Navy Departments and there are some indications that increased progress in aeronautics will warrant its development in the near future.

Naming and Classifying Airplanes

United States

The Engineering Division of the U. S. Army Air Service adopted, in the fall of 1919, the following type system for the standardizing of the classification of airplanes only:

TYPE	DESCRIPTION
I	Single-seater pursuit, water-cooled engine.
II	Single-seater pursuit, air or water-cooled engine, for night attack.
III	Single-seater pursuit, air cooled engine.
IV	Single-seater pursuit, air or water-cooled engine, for ground attack.
V	Two-seater pursuit, air or water-cooled engine.
VI	Three-seater, air or water-cooled engine or engines, for ground attack.
VII	Two-seater Infantry liaison, air or water-cooled engine.
VIII	Two-seater night observation, air or water-cooled engine.
IX	Three-seater Army and Coast Artillery observation and surveillance, air or water-cooled engine or engines.
X	Two-seater corps observation, air or water-cooled engine.
XI	Two or multi-seater day bombardment, air or water-cooled engine or engines.
XII	Two or multi-seater night bombardment, short distance, water-cooled engine or engines.
XIII	Multi-seater night bombardment, long distance, water-cooled engine or engines.
XIV	Two-seater training, air-cooled engine.
XV	Two-seater training, water-cooled engine.

The Army Air Service has previously adopted no system similar to that of France or England for the standard designation or classification of aircraft, save that the following letters have been added in some instances to the designer's or manufacturer's model number:

G—Gunnery
O—Observation
P—Photography
C—Combat
B—Bombardment

For instance, the JN-6HP is a Curtiss training machine, similar to the JN 4H but equipped for aerial photography. The S-4C is a Thomas-Morse single-seater pursuit-plane, "C" being used as *Chasse* (pursuit) in the French system.

British

Nomenclature of airplane types in Great Britain consists of the use of two words. The manufacturer selects the first word, usually the principal one in the firm's title. The second word is selected by the table following.

EXAMPLES: Sopwith "Pup"—A single-seater, one-engined airplane designed by Sopwith Aviation Co.; Vickers "Surrey"—A multi-engined airplane with a gross weight of between 20,000 and 44,999 lb. inclusive, designed by Vickers, Ltd.

This classification system is not, as yet, in general use as will appear obvious from past and present names of British airplanes. The "nicknames" are registered. Changes in design not radical enough to warrant a change in name are noted by mark numbers.

Type of design	Class of Name	Airplanes for use on land or from ships' decks	Seaplanes
	Airplanes with one engine only		
Monoplane	Zoological	(Land birds (except birds of prey) (Reptiles (except snakes)	
Multiplane	Zoological	Mammals (except felidae)	Waterfowl birds

Gross weight Over lb.	Up to lb.	*Airplanes with more than one engine*		
...	11,000	Geographical	Inland towns in England or Wales	Seaboard towns in England or Wales.
11,000	20,000	Geographical	Inland towns in Scotland or Ireland	Seaboard towns in Scotland or Ireland.
20,000	45,000	Proper names	Male historical or mythological proper names (excluding names of stars or planets)	Same but female
45,000	—	Attributes	Terminating in "ent", "ant" or "ent"	Terminating in "is," "ar" or "on"

The names excluded above are reserved for denoting engine designs

French

The method used by the French government is to designate the make, model, general purpose, direct use, and number of seats by using the first three letters of the designer's or maker's name, followed by the other symbols which have been established.

EXAMPLES: Bre 14 Bn2 Breguet, model 14; bombardment, night; two-seater. Voi 8 Ca2: Voisin, model 8, cannon, two-seater.

Capital letters indicate the general purpose, as follows:

A Corps d'Armee (Reconnaissance, Observation)
B Bombardement (Bombardment)
C Chasse (Pursuit, Scout, Combat, Fighter)
Ca Canon (Airplane fitted with small cannon)
L Liaison
F Fortresse (A heavily armored airplane)
D Double commande (Dual control machine)
E Entrainement (Training)
H Hydravion (Seaplane, Flying Boat)
P Photographie (Photographic airplane)
R Rouleur (Low powered airplane, not capable of sustained flight, used for primary training purposes)

a Strafing, airplane for machine gunning ground targets
b Blinde (Armored airplane for strafing)
n Nuit (Airplane intended for night flying)
p Long distance reconnaissance airplane
2, 3, *etc.* Number of seats.

French Aircraft Customs Regulations

The French regulations and customs formalities to be applied to all aircraft entering or leaving France have only recently been published (Jan 18, 1921).

The Under Secretary of State of Aeronautics and Aerial Transport, pursuant to the decree of July 8, 1920, as regulating air navigation, has ordered as follows —

Article I—Aircraft going abroad cannot leave except from aerodromes specially designated for this purpose by the customs administration and classed as "customs aerodromes".

Those coming from abroad may not land except at the same aerodromes.

Article II—Any aircraft crossing the frontier is under the obligation to do so between certain determined points. These points fixed after agreement with the interested States are indicated on the aeronautical maps.

Article III—When in case of absolute necessity, proof of which must be furnished, the aircraft crosses the frontier at a point other than that designated, it must land at the nearest customs aerodrome situated on the itinerary of its flight. If it is obliged to land before reaching this aerodrome, the pilot of the aircraft shall immediately inform the nearest police or customs authorities.

He shall also inform without delay the mayor of the district in which the landing took place, who shall take the necessary steps to see that the cargo is not removed, or the material either, until the fiscal agents have been able to make the necessary examinations and other inspections. The pilot cannot resume his flight until so authorized by these services, which after examination will affix their visa to his itinerary records and the manifest of the merchandise; they shall indicate to which customs aerodrome the pilot must go to fulfill the customs formalities.

Article IV—Exceptions to the general rules may be made for certain categories of aircraft, notably postal aircraft, those belonging to air transport companies, regularly constituted and authorized, and those belonging to members of organized tourist associations, and not engaged in the public transportation of persons or in the transportation of merchandise. These categories may be exempted from the obligation of landing at the customs aerodrome and authorized to commence or finish their flight at certain aerodromes of the interior designated by the customs and police administrations and where the formalities demanded by the customs and the police are complied with. However, such aircraft must follow a determined air route and establish its identity by suitable signals on crossing the frontier.

These signals shall be determined by ministerial orders.

Article V—All aircraft in flight, no matter where it may be, must conform to the injunctions of the police or customs stations and aircraft.

Article VI—Before their departure or on their arrival, according to whether they are going abroad or have come from abroad the pilots must present to the authorities of the aerodromes their itinerary records, and if necessary, the manifest of the merchandise and provisions that they are carrying.

The manifest shall conform to example No. 1 annexed hereto.

It is obligatory that merchandise shall be declared in detail by the shippers and be conformable to example No. 2 annexed hereto.

Article VII—Before departure, if it be a question of aircraft transporting merchandise, the fiscal agent on production of the manifest and of the declaration shall proceed to make the customary examination and shall affix his visa to the itinerary records as well as to the manifest. His signature shall be supported by his seal.

He shall also place a seal on the merchandise or the groups of merchandise for which this formality is demanded. On arrival, the fiscal agent shall verify that the seals are intact, and shall proceed with customs formalities, visaing the itinerary records and keeping the manifest.

If the aircraft does not carry merchandise it shall merely be subjected to the visa of its itinerary records by the police and customs services.

Article VIII—Foreign aircraft landing in France shall, in principle, pay customs duties.

If they are to be re-exported they shall benefit by the system of permit and deposit of duty charges. Aircraft from the countries which have formed together with France a union of the recognized tourist associations enjoy the system of the triptych.

Fuel on board is not liable to customs duty unless the quantity exceeds that necessary for the accomplishment of flight as stated on the itinerary records.

Article IX—Merchandise arriving by aircraft shall be considered as coming from the country where the itinerary records and the manifest were visaed by the fiscal agent.

As regards their origin and the diverse customs systems they shall be subject to rules similar to those applicable to merchandise imported by land or by sea.

Article X—The following shall be considered as imported or exported fraudulently:

(a) Aircraft coming from abroad which has not entered France by the routes determined by international agreements;

(b) Those wishing to land in France which have not landed at one of the appointed aerodromes;

(c) Aircraft going abroad which has not started from customs aerodromes, or which has crossed the frontier at a different point to the routes provided for by international agreements.

Article XI—All the provisions of the laws relative to the repression of infractions of the customs regulations shall be applicable to aircraft and to merchandise imported or exported by aircraft under any customs regime whatsoever.

EXAMPLE NO 1
AERIAL NAVIGATION
General Manifest or Declaration of Load

(Space reserved for inscriptions of customs service)

Machines — Registry mark (Name)
Commander — (Residence) (Nationality) (No of License) (Place of departure Country)
Merchandise. (Place of destination Country) (Number of declarations attached)

The commander affirms the correctness of this manifest under the penalties prescribed by law. In consequence, he has dated and signed this document immediately under the last inscription.

Remark.—The manifest must bear no erasures or words written over others not approved by qualified customs agents nor contain interlined words nor several articles on the same line. As many interpolations as necessary may be added.

Serial number of this document	Marks and numbers of packages	Number (in figures and words) and kinds of packages	Nature of Mdse	Weight	Remarks

EXAMPLE NO 2
AERIAL NAVIGATION

Place of departure
Place of destination
Customs declaration made by M ... for the following merchandise

Packages Marks and numbers	Packages Number	Kind	Detailed list of contents	Country of Origin	Value	Weight Gross	Weight Net	Remarks

All unauthorized unloading and throwing out of goods in course of flight, except ballast and postal mail, in the bases officially designated therefor, shall be punished by the penalties inflicted by the customs laws against smuggling.

Article XII—As regards merchandise imported in transit or to be warehoused, or subject to domestic taxation, the shippers shall furnish proof of their departure to the foreign country by the production within the stated time-limits of a valid certificate from the customs at their destination under penalty of payment of the fees provided for by Article 5 of the law of July 5, 1836.

Article XIII—Article 463 of the penal code shall not be applicable to the infractions covered by the present order and punishable by the customs laws.

Article XIV—The employees of the customs, of the indirect taxation offices, of the city tolls, the agents of water-courses and forests, the offices of the judicial police, the gendarmerie, the military forces, mayors, and the agents of the military maritime or aerial authorities commissioned to this effect, shall be charged, each in so far as he is concerned, with the execution of the present order.

Given at Paris, Jan. 12, 1921.

P. E. FLANDIN

The Famous Bombing Chart

The chart which is illustrated herewith is the one which recently caused so much comment in Congress and in Army and Navy circles. It shows the location of the hits obtained by bombs dropped from aircraft at a level of 6,000 ft. against a ground target around which a modern battle cruiser is outlined. The full line indicates the ship, while the dotted line shows the danger zone in which hits by aircraft bombs would prove at least partly effective. Out of 251 bombs dropped during this test, 55 were direct hits and 50 were within the danger zone, which gives a total of 105 effective hits, or an accuracy of 41.8 per cent.

Cross Channel in Gale

During a big gale recently none of the cross-channel steamers got across either way between England and France, says London Opinion. But Mr MacIntosh of Handley-Page Transport, Ltd., fought his way through the hurricane from Paris to Lympne, taking over three hours for the 180 miles on a D. H. 8 with a Siddeley engine, and Vaughan Fowler did the 240-mile journey from London to Paris with the wind behind in an hour and 40 minutes on an old D. H. 4 with a Rolls engine. These were the only craft to get across, so after that it looks as if the surest way of getting mails through is by air.

The New Berliner Helicopter

The accompanying illustrations are reproductions of two hitherto unpublished photographs of the helicopter invented by H. A. Berliner, of Washington, D. C. The trial ascent which the upper photograph illustrates took place on June 10, 1920, the machine rising on that occasion to a height of 5 ft. The first successful ascent of the Berliner helicopter occurred on Nov. 11, 1919, also at Washington, D. C., and was illustrated at the time in AVIATION AND AIRCRAFT JOURNAL. A comparison of the two pictures shows that the original machine has been altered by the addition of vertical stabilising planes and a large rudder, obviously with a view to improving its stability. The fitting of skids on either side of the undercarriage is also noteworthy.

TWO VIEWS OF THE NEW BERLINER HELICOPTER

Although constructional details of this interesting machine are not available, the upper picture shows how the vertical stabilizers are tilted sidewise to counteract what appears as the lack of synchronization between the two propellers or the difference between their respective speed.

Field for Minnesota Aero Squadron

The 1st Minnesota Observation Squadron may get a flying field near St. Paul.

Sen. W. F. Brooks has offered a bill in the Senate which would authorize a 10-year lease on aviation field property at a yearly rental of $2,500.

It stipulates the field shall be near the Twin Cities.

An added appropriation of $50,000 for building and equipment is provided.

Air Service Medical Policy

A board of officers was recently convened by the Chief of Air Service to recommend a definite policy as to the physical standards considered necessary by the Air Service for applicants for flying training in both heavier-than-air and lighter-than-air service.

The action of the board, which was approved by the Chief of Air Service was as follows:

"The Board recommended unanimously that no waivers of physical defects be recommended in the cases of applicants for flying training, except such minor physical defects as would, in the opinion of the Chief Surgeon of the Air Service, have no bearing on his duties as a pilot or as an observer in either heavier-than-air or lighter-than-air service."

Mobilizing at Langley Field for Bombing

Information that nearly all the bombing airplanes in the Army Air Service and many pursuit planes are being drawn from various flying fields for concentration at Langley Field, Virginia, has been confirmed.

It is significant that this bombing test is to take place at the same place the Monitor and Merrimac had their famous encounter. Many aviation followers believe that this Air Service test may have as important results as the "cheese box" achieved in a few hours in Hampton Roads.

More than 100 airplanes and several balloons and dirigibles will be mobilized there within this month, along with large stores of bombs, aerial torpedoes and other aviation fighting equipment.

During the last few days several pilots stationed at Mitchel Field, Mineola, N. Y., have been transferred to the Virginia aviation field.

The ammunition stored at Langley Field was said to be "enough to blow up both the Pacific and Atlantic fleets," the bombs varying in weight from fifty to two thousand pounds.

The aircraft concentration at Langley Field, it was understood, will include twenty S.E.5's, forty De Havilands, twenty-one Martin bombers, some of them equipped with the new aerial torpedoes, six Handley Pages and six Caproni's for day and night bombing, twenty flying boats and nine craft of the lighter-than-air type.

Col. T. De Witt Milling, who was assistant to Brigadier General Mitchell in charge of military aviation in France, will command the armada of heavier-than-air machines at Langley Field, while Col. William C. Hensley will be in charge of the balloons and dirigibles.

The mobilization of aircraft and personnel at Langley Field, Virginia, is for the purpose of conducting training flights in preparation for bombing tests against naval vessels. The tests will take place in June and a large number of army airplanes and several dirigibles will take part in addition to all available naval air forces.

"This is the first opportunity we have had," an Air Service officer in Washington said, "for any real training since the end of the war. We expect to have at Langley Field before the bombing tests take place about 100 planes of all types, including more than a score of the new big Martin bombers, and the necessary personnel. The bombing flight training periods also will give pilots from other posts an opportunity to attend the air service officers' school at Langley Field."

The fliers already at Langley Field and those who have been ordered to report there are being trained in flying over the water and dropping bombs at moving targets on the surface of the ocean, officers said. Other tests are being conducted over the land against the outlines of battleships drawn on the ground.

Aviators Are Enthusiastic

Army aviators have become so enthusiastic over the proposed experiment of bombing naval vessels under approximately war time conditions that scores of them have suggested that the fleet be allowed to fire back at them with anti-aircraft guns.

While Admirals and Generals have been advancing and disputing claims that the airplane is far superior to the battleship as a war weapon, army pilots have flooded the office of the air service director with pleas that the matter be settled under honest to goodness war conditions.

They have been all wrought up over the subject since that not distant day when Josephus Daniels, then Secretary of the Navy, offered to stand bareheaded on a deck of a battleship and let Brig.-Gen. Mitchell, head of the air service in the war, take a crack at him with a bombing airplane.

Lieut. C. C. Moseley, victorious pilot in the recent airplane race at Mineola Field for the Pulitzer trophy, desires the opportunity of a real fight with the navy gunners.

"I firmly believe," he wrote, "that a bunch of those gobs would have about as much chance of hitting one of us (especially if the old battleship were in motion) as the proverbial snowball."

"With a fast plane I would feel perfectly secure to fly around all day over the Atlantic fleet and let them shoot at me with anything they have—anything from a popgun to a 16 inch piece," read a letter from Capt. Harvey Weir Cook of Fort Cook, Nebraska.

Other army fliers, scattered over fields in many parts of the country, chimed in with similar willingness, each one asking to be allowed to take part in the experiment, should it ever come about.

One officer, stationed at Carlstrom Field, Arcadia, Fla., while highly desirous of "getting in on the fun" doubted whether the men higher up in the army and navy would let the dream come true. He gave a thought to public opinion, and his doubt increased.

"I'm afraid the general public would raise a chickens of a row," his letter said.

Another flying Lieutenant willing to take a fling at the experiment feared the sailors might not enjoy it so much. He suggested that the naval man firing the anti-aircraft guns be allowed to mount them on craft other than the battleships under attack from the air.

Bombing Practice Going On

Meanwhile in several of the air service flying fields bombing practice against silhouette warships placed upon the ground is being carried on. Official tests with a view to determining the relative value of aircraft in warfare are being conducted at the Aberdeen proving ground in Maryland.

Army fliers say they could sink the biggest battleship with one direct hit with a 1,100 lb. bomb dropped from an altitude of 9,000 ft. They contend that the explosive would have such force it would buckle the plates of the warship, making it impossible to keep afloat.

As to their own safety in air peppered by anti-aircraft ammunition, the army pilots who saw service over the lines in France assert that results of attacks upon aircraft from the land were few, and they point out that all planes brought down were crippled by guns on fixed land mountings, while in the projected encounter with the fleet the battleships would have to keep moving.

Fireproof Cover for Gas Tanks

A fireproof cover for the gasoline tanks of airplanes designed by aeronautical experts of the Goodyear has been accepted by the government for use on combat and mail planes according to company officials.

The cover was designed especially for combat airplanes for protection against incendiary bullets and is not only fireproof but leakproof and crashproof as well.

The cover consists of a sheet of soft but very tough rubber, one-half inch thick, laid on several plies of high grade cotton fabric. The rubber is applied next to the tank. In tests, it was found that when the gasoline tank was punctured, the rubber immediately closed the hole and stopped the leak.

Wade Van Orman, of the Goodyear aero design department, developed the cover.

Maryland Air Unit

Maj. George L. Jones has been recommended for appointment as chief air officer of the Maryland National Guard.

The unit will be an observation squadron, and will have a complement of 35 officers and 100 enlisted men. The organization chart calls for 1 major, 7 captains, 13 first lieutenants, 14 second lieutenants, 4 master sergeants, 4 technical sergeants, 1 first sergeant, 19 staff sergeants, 12 corporals, 35 privates, first class, and 72 privates.

Mr. Jones who was a major in the Air Service during the war will receive a majority in the militia if Gen. Milton A. Record, Adjutant General of the State Guard, approves the recommendation.

"Who's Who in American Aeronautics"

Jesse Gurney Vincent

VINCENT JESSE GURNEY, Vice-President of Engineering, Packard Motor Car Co., Detroit; born Charleston, Ark., Feb. 1d 1880, son of Joseph M. Vincent and Nellie (Gurney) Vincent; married Clarinda Blood, Oct. 2 1909.

Educated: Country school near Fana, Ill.; Cole Brilliant Grammar School St. Louis, Mo.

Professional: 1d97-1898, Bookkeeping and General Business, Smith, Vincent & Co., 1898-1902 Machinist & Toolmaker St. Louis, 1902-1910 Supt. of Inventions Burroughs Adding Machine Co., Detroit 1910-1d12, Chief Engineer Hudson Motor Car Co., Detroit 1d13-1d17, Vice-President of Engineering Packard Motor Car Co.

U. S. Air Service: 1917 to Nov. 1918, Packard Motor Car Co., Vice-President of Engineering, 1d18-1921.

Aeronautical Activities: Aug. 1d, 1917 commissioned Major in Signal Corps, Accepted Sept. 4, 1d17. Oct. 17, 1d17, started to build experimental aircraft engineering station at McCook Field Dayton, placed in Command of McCook Field Dec. 7, 1d17. Commissioned as Reserve Military Aviator, Aug. 6 1918, designated Chief of Airplane Engineering Division with title of Chief of Engineering Sept. 13, 1918, detailed to membership of Joint Army and Navy Technical Aircraft Board Special Order Dated Nov. 8, 1d18 designed with E. G. Wall the Liberty Engine.

Flying Rating: Colonel, Aviation Section (Flying Status) Signal Officers' Reserve Corps, U. S. Army.

Member: Aviation Country Club, Detroit Club Detroit Board of Commerce, Old Club; Society of Automotive Engineers, American Society of Mechanical Engineers, Institute of Automobile Engineers (London) Aero Club of America.

Present Occupation: Vice-President of Engineering Packard Motor Car Co., Detroit.

Address: E. Grand Blvd., Detroit, Mich., home, 53d E. Grand Blvd., Detroit, Mich.

Charles Frederick Marvin

MARVIN CHARLES FREDERICK, Chief U. S. Weather Bureau; born Putnam now part of Zanesville, Ohio, Oct. 7, 1858, son of George Frederick Adams Marvin and Sarah Ann (Speck) Marvin; married, Nellie Linsbrunner, June 27, 1894 (Died), Feb. 27 1900) Retta Mabel Barth, now living, 1911.

Educated: Public Schools Columbus, Ohio; Graduate of Mechanical Engineering, Ohio State University, 1882.

Professional: Sept. 1 1884, appointed Junior Professor in Office of Chief Signal Officer of the Army, assigned to charge of 1st Division of Weather Bureau 1886, until appointed Chief of Weather Bureau, Aug. 4, 1913.

Aeronautical Activities: The invention and development of kites and related aerial apparatus for exploration of the free air; Commissioned by the President as a member of the National Advisory Committee for Aeronautics; member of the Executive Committee thereof, also of Committee on Aerodynamics. Chairman of Committee on aircraft materiels.

Books: Numerous articles on Meteorology in general, including theoretical and practical, papers on the use of kites in the exploration of the air, and other related subjects.

Member: Cosmos Club (Wash.) Fellow of the American Ass'n. for the Advancement of Science; Philosophical Society of Washington D. C.; Washington Academy of Sciences; Scientific Society of America; American Meteorological Society.

Present Occupation: Chief of U. S. Weather Bureau.

Address: 24th & M Sts., N. W., Washington, D. C., home, 1601 Emerson St., N. W., Washington, D. C.

Augustine Warner Robins

ROBINS, AUGUSTINE WARNER, Major, U. S. Army Officer; born, Gloucester, Va., Sept. 29, 1880; son of Colonel Wm. Todd Robins and Sally Nelson Robins; married, Dorothy Gretchen Hyde, Jan. 6, 1d14.

Educated: Richmond High School, Richmond, Va.; Graduate U. S. Military Academy West Point, N. Y.

Professional: Officer U. S. Army 2nd Lieut. 12th Cavalry, June 14, 1907; 1st Lieut. 12th Cavalry, Sept. 1d, 1d14. Major Air Service, July 1 1920.

Aeronautical Activities: Major, Aviation Section Signal Corps, Aug. 5, 1d17. Lt. Col., Air Service, Aug. 17, 1d18. Junior Military Aviator, Aug. d, 1d18. Duty at Scott Field Ill. and Park Field Tenn. Oct. 1, 1d17 to June 18 1d18. Commanded Scott Field, Ill., June 1d, 1d18 to Oct. 1, 1d18. Supervisor Northern Air Service Dist., to Feb. 1, 1919 Chief Property and Requirements Division and Asst. Chief Supply Group Air Service.

Member: Army and Navy Club, (Wash.), Army and Navy Club, Manila, P. I.; U. S. Air Service Association.

Present Occupation: Assistant to Chief of Supply Group Air Service.

Address: Air Service, Washington, D. C., home, The Burlington Hotel, Washington, D. C.

George Owen Squier

SQUIER, GEO GWEN Major General, Chief Signal Officer U. S. Army; born Dryden, Mich., March 21, 1865, son of Alinson Justice Squier and Emily (Gardner) Squier; unmarried.

Educated: Dryden Public Schools, Michigan, graduate of U. S. Military Academy, West Point, 1887 Fellow, Johns Hopkins University, Baltimore, Md., 1d01 Ph. D., Johns Hopkins University.

Professional: Officer of the U. S. Army appointed 2d. Lt. 3d Artillery, June 1d, 1887 1st Lt., June 30, 1898 Capt. Signal Officer Vols., May 26, 1898 Lt.-Col. Chief Signal Officer Vols., July 1d, 1898 has discharged from Vols., Dec. 7, 1898 1st. Lt. Signal Corps U. S. Army, Feb. 2d 1899 Capt. Signal Officer Vols., April 17, 1898 hon discharged from Vols., June 30, 1901, Capt., Signal Corps U. S. Army Feb. 2, 1901, Maj., March 2, 1902, commanding U. S. Cable-ship Burnside 1900-1902, during laying of Philippine cable-telegraph system U. S. Military Attache at London England, 1d12 Lt.-Col., Signal Corps, Col. Signal Corps, Major General, Signal Corps, Chief Signal Officer.

Aeronautical Activities: In charge of the U. S. Army Air Service from June 1d1d in May 1d18.

War Honors: July 2 1d1d decorated with the insignia of Companion of the Order of Knights Commander of St. Michael and St. George, by Field Marshal Sir Douglas Haig, at London, England, Sept. 5, 1d1d decorated by Distinguished Service Medal, U. S. Army for exceptionally meritorious and distinguished service May 1d18 awarded the Franklin Medal by the Franklin Institute, Philadelphia, Pa. April 1919, elected member of National Academy of Sciences.

Books: Military Aeronautics, 1d04, "Aeronautics in the United States," 1d14.

Member: Army Club of America, American Association for Advancement of Science, American Institute of Electrical Engineers, American Physical Society, National Academy of Sciences, Institute of Radio Engineers, Franklin Institute, Physical Society of London, Army and Navy Club, Chevy Chase Club, University Club (N. Y.), Metropolitan Club.

Present Occupation: Major General, Chief Signal Officer of the Army.

Address: Chief Signal Officer, War Department, Washington, D. C., home, The Bachelor Apartment, 1737 H Street, N. W., Washington, D. C.

George Reed Wadsworth

WADSWORTH, GEORGE REED, Consulting Engineer; born Keene, N. H., Aug. 22, 1876; son of Samuel Wadsworth and Ella Frances (Reed) Wadsworth, married, Alice Marion Goodale, April d, 1902.

Educated: Keene, N. H. High School, B. S. in Civil Engineering, 1898, Massachusetts Institute of Technology.

Professional: 1d98-1d99 with New York Central Railroad, Maintenance of Way Dept., designing Engineer and Resident Engineer on Grand Central Terminal Improvements. 1905-1907 with J. G. White & Co. Inc., N. Y., Engineer on contract work, Steam and Electric Railroad Construction, Hydro-Electric and Harbor Development. 1907-1909 Consulting Engineer to Metropolitan Improvements Commission, Boston, Mass., rendered report to Commissioner embodied in Committee's report to The Commonwealth covering complete Unification and Operation under joint control, of all passenger and freight steam railroad and terminal properties and facilities within the Boston Terminal District, covering also proposed development of Boston Harbor to provide additional waterfront facilities 1909-1d12 Consulting Engineer on Terminal Transportation and allied problems in connection with city planning. 1d10-1d13 Engineering Manager and Chief Engineer, Peerless Motor Car Co., Cleveland, Ohio 1d13-1d16 Assistant to the President, Gray & Davis Inc., Boston Manufacturers of automotive starting & lighting equipment.

Aeronautical Activities: April, 1d17 civilian appointment, Aviation Section S. C., U. S. A., commissioned Captain June 1d17, Major, Oct. 1d17 to Oct. 1d1d Chief Engineer Naval Aircraft Factory, Navy Yard, Philadelphia, Pa. Dec. 6d, 1918 Honorably Discharged.

Member: American Society of Civil Engineers, American Society of Mechanical Engineers, Society Automotive Engineers, University, Engineers, Technology and Aero Club of America (N. Y.)

Present Occupation: Consulting Engineer.

Address: 42 West 40th St., New York, home, 66 West 67th St., New York.

Clement Melville Keys

KEYS, CLEMENT MELVILLE, Banker and Broker; born, Chatsworth, Ont., Canada April 7, 1876 son of George Keys and Jessie Margaret (Evans) Keys, married, Florence B. Hays, June 15, 1d0d.

Educated: Lindsay (Ontario) High School, B. A. 1897 Toronto University.

Professional: Teacher of Classics, Ridley College, St. Catherine's, Ontario, 1898-1900 Railroad Editor "Wall Street Journal" 1900, Financial Editor "World's Work" 1dd0-1d11 Banker and Broker, Corporation Financial Advisor Vice President, Curtiss Aeroplane and Motor Corp., 1d16 President, Curtiss Aeroplane and Motor Corporation 1920.

Aeronautical Activities: President, Curtiss Aeroplane and Motor Corporation.

Member: Banker's Club National Arts Club, Sleepy Hollow Country Club Glen Ridge Country Club, Nutley Field Club Hudson River Country Club.

Present Occupation: President, Curtiss Aeroplane and Motor Corporation.

Address: 60 Broadway, New York, home, 288 Ridgewood Avenue, Glen Ridge, N. J.

Benjamin Frederick Castle

CASTLE BENJAMIN FREDERICK, Banker, born Portage, Wis., May 11, 1884, son of Frederick G. Castle and Frances (Dudd) Castle; married Winifred A. Talbot, Dec. 28 1907.

Educated: Milwaukee, West Division high school U. S. Military Academy, West Point.

Professional: U. S. Army Officer, 1907 to Oct. 24, 1d1d 4th Lieut. Army, Jan. 1907 to 1d14, 1st Lieut. and Capt. 14th Infantry 1d14 to 1d17; Major Air Service 1d17 Lt. Col. Air Service, 1d18 to 1d1d.

Aeronautical Activities: Detail Major Air Service Aug. 1d17 Construction Division A. S. S. C. selecting and inspecting flying fields, Oct. 1d17 to 1918 Flying Instructor and duty Rockwell Field, Calif. March to July 1d18, Control Board, Air Service, Washington, D. C., July 1d1d to Feb. 1d19 Attached to U. S. Liquidation Commission as Air Service representative, Paris Feb. to July 1d1d; Aviation Attache, U. S. Embassy Paris July to Oct. 1d1d.

Flying Rating: Junior Military Aviator.

Member: University Club, (Buffalo, N. Y.), Army and Navy Club (Wash.), Aero Club of America.

Present Occupation: Banker Irving National Bank, New York.

Address: Irving National Bank, N. Y., home, 68 Washington Ave., New York.

August Belmont

BELMONT, AUGUST, Banker, born New York N. Y. Feb 18, 1853, son of August Belmont and Caroline Slidell (Perry) Belmont; married Elizabeth Hamilton Morgan, 1d81.

Educated: Rectory School, Connecticut; Exeter Academy; B. A. 1d74, Harvard University.

Professional: Entered office of father's banking business 1d76. Built first New York Subway; also built Cape Cod Canal.

Aeronautical Activities: Commissioned a Major in the Aviation Section of the Signal Corps in France, Nov. d, 1d17. Assigned to purchasing department under Col. C. C. Pearsall; was sent by General Pershing on special mission to Spain to arrange for supplies from that country for the A. E. F.

Member: Knickerbocker Union, Midday, Harvard, N. Y. C., N. Y. A. C., Auto Automobile, Meadow Brook, Jockey Club, Turf & Field, Southside, Indian House, Church Club, Sons of the Revolution.

Present Occupation: Banker.

Address: 43 Exchange Place, New York, home, 907 Fifth Avenue, New York.

Lawrence B. Sperry

SPERRY, LAWRENCE B., Manufacturer: born Chicago, Ill., Dec 21 1892, son of Elmer A. Sperry and Edna (Goodman) Sperry, married, Winifred Allen, Feb 16 1918

Educated: Public schools, Evanston Ill.

Professional: Manager Airplane Dept. Sperry Gyroscope Co., 1912-1917 Manufacturer of airplanes and instruments 1917 to present, under firm name of The Lawrence Sperry Aircraft Co Inc

Aeronautical Activities: Started by building own plane Fall 1909 Saw same 1911 (tractor biplane) in towed flight, 1911, flew plane with 8-cylinder Anzani Motor, 1914, won first prize in French Security Contest.

Flying Rating: Hydroaeroplane license, Expert license and Naval Aviator license.

War Service: First man to join Naval Flying Corps Class No 8, Jan 4, 1917; Naval service ended by crash in experimental aerial torpedo.

Member: Aero Club of America, Garden City Gold Club, Cherry Valley Gold Club Society of Automotive Engineers

Present Occupation: Manufacturer

Address: Main Street, Farmingdale, L. I; home, 1 Garden Place, Hempstead

Horace Meek Hickam

HICKAM, HORACE MEEK, Major, U S. Army: born, Spencer, Ind Aug 14, 1884, son of Hon Willis Hickam and Sarah Hickam, married, Helen Johnson Bamber, April 20 1912

Educated: Entered public school and high school, Naval Electrical College, Washington

Professional: Wireless Construction Engineer Through various posts until 1911 1911 for Amazon Wireless Co International Telephone & Telegraph Co. and the Brazilian Government.

Aeronautical Activities: Exhibition pilot 1913-1916, instructor and test pilot for Orville Wright, 1913-1916 Gen Villa, Mexico 1914, The Dayton Wright Co. 1916-1921.

Flying Rating: Pilot since 1913

Present Occupation: Pilot and assistant aeronautical engineer

Address: Dayton Wright Co. Dayton, Ohio, home, 650 Belmont Park, Dayton, Ohio

Archie Miller

MILLER, ARCHIE, Lt. Col U S Army: born, Chicago, Ill, Sept. 28, 1878, Son of William Henry Harrison Miller and Jane (Allen) Miller Married Madeline Whiteide, Oct. 14 1906

Educated: public schools Kansas City, Mo., A. B U., Mary's, Kansas and St. Louis University

Professional: Served in State Volunteers in Cuba 1898 as 1st Lt., served in U S. Volunteers in Philippines, 1899-1901 as 1st Lt., served in Regular Army (Cavalry) as commissioned officer since 1901

Aeronautical Activities: Lt. Col. Air Service Oct. 1, 1917, Colonel Air Service Sept. 20, 1917 Lt. Col Air Service July 1, 1920, Commanding officer, Kelly Field No 6, Col. and Nov 1917 Commanding Officer, Aviation Camp, Waco, Texas, December 1917 May 1918, Commanding Officer Camp Greene, N C., June and July 1918 Commanding Officer, Air Service Activities, Long Island, N Y., Aug-Oct. 1918 Assistant to Director of Military Aeronautics, Nov 1918-Feb 1920 Commanding Officer, Kelly Field, Texas, March Aug. 1920, General Staff College, Sept. In charge arrangements as Long Island, New York-Toronto Race, Transcontinental Airplane Race, Reception of Dirigible R-34, Belmont Park Airplane races, Sheepshead Bay Flying Circus.

Flying Rating: Junior Military Aeronaut, Airplane Pilot.

War Service: Spanish American War, Philippine Insurrection Mexi Campaign World War

War Honors: Congressional Medal of Honor

Member: Army and Navy Club (Wash.) Aero Club of America.

Present Occupation: Detailed to General Staff College

Address: General Staff College, Washington, D C Home Burlington Hotel.

Grover C. Loening

LOENING, GROVER C., Aeronautical Engineer: born, American Consulate Bremen, Germany, father was United States Consul and U. S. Citizen and born in U S A, son of Albert Loening and Hermine E Loening

Educated: Cutler school, New York City, Lawrenceville school Lawrenceville N. J, B. Sc., A. M., C. E, Columbia University

Professional: Chief Engineer, Queen Aeroplane Co., New York, 1911-1913, General Manager, The Wright Co., Dayton, Ohio, 1913-1914 Chief Aeronautical Engineer U S Army Air Service, 1914-1917, Vice President and General Manager Sturtevant Aeroplane Co, Boston Mass 1916-1917, President, Loening Aeronautical Engineering Corp, 1917 1921

Aeronautical Activities: Built and flew in short straight-away, first flying boat, 1911-1913. Originated monoplane flying boat, also originated at Wright Co., 1912-1913, first American shortfall flying boat Invented first monoplane rigid Grasing pursuit machine at San Diego 1914, Built at San Diego, 1915, Signal Corps tractor used by Lt. B Q Jones in establishing world's three passenger endurance record and by Lt. T E Dodd in cross-country record, etc., Introduced steel construction 1916, Sturtevant biplane; Began in 1917 basic design and development of the Loening monoplane, and the Loening Seaplane, and continues development new and original designs for U S Government.

Books: "Monoplanes and Biplanes," 1917 'Military Aeroplanes," 6 editions, 1916-1918, "Revival of the Monoplane", and numerous papers and articles

Member: Aero Club of America, Society Automotive Engineers, Army and Navy Club (Wash.), New York Yacht Club, Seawanhaka-Corinthian Yacht Club, Columbia University Club, Society of Sigma Xi

Present Occupation: President, Loening Aeronautical Engineering Corp

Address: 241 West 42 Street, Mines, 116 East 63 Street, New York.

Garland Fulton

PULTON, GARLAND, Lt. Commander, U. S. N: born University, Miss, May 6, 1880, son of Robert Emmell Fulton and Annie (Garland) Fulton married, Gertrude Russell Langdon, July 28 1914

Educated: Public and private schools in Miss and Va., entering U S. Naval Academy 1912, 1916, M S. in Naval Architecture, Mass Inst. Technology

Professional: Served on various ships and at various Navy Yards actively engaged on aeronautical work since 1916

Navy Service: Commissioned Asst Naval Constructor Rank, Lieut. (J G) 1914 promotion in due course to present Rank of Lieut. Commander

Aeronautical Activities: Brief Course in Aeronautics 1913-1916 at M. I. T., in connection with Naval Constructors course in Naval Architecture, on Aeronautical duty in Bureau of Construction and Repair, Navy Department.

Member: American Society Naval Architects, Army and Navy Club.

Present Occupation: On Aeronautical duty in Bureau of Construction and Repair, Navy Department, Washington D C

Address: Navy Department, Washington, D. C.

Ralph Haskett Upson

UPSON, RALPH HASLETT, Aeronautical Engineer: born New York City, June 26, 1883, Son of William F Upson and Grace (Haskett) Upson, Married Frances Allen, May 16, 1914

Educated: public schools Glen Ridge, N J., M. E Stevens Institute of Technology, 1910.

Professional: Aeronautic Experimental Engineering, Automobile tire research work, started Education and Safety First departments, technical supervision of all new inventions, member factory suggestion committee, Goodyear Tire and Rubber Co., Akron, Ohio

Aeronautical Activities: Made first balloon flight 1906, assisted Aerial Transportation Associates, Hammondsport, N Y., 1908, Aerodynamic research work, 1909, Aeronautic Sales Department Goodyear Tire and Rubber Co., 1910-1911 Construction Foreman for Vaniman Airship Eagalop, 1911 Designed and built first complete balloon, 1916, Commenced experimental study of airship engineering, introduced system of water model testing, 1916, Organized Goodyear Aero Club, 1913, won National and International Ellison Cup, 1913

Flying Rating: Pilot's certificates, Balloon and Airship, F A I

Member: Akron Club, Aero Club of America, Society of Automotive Engineers, American Meteorological Society, In Charge, Lighter-than Air Department, Alexander Klemin and Associates, Consulting Aeronautical Engineers

Address: 22 East 17th Street, New York

Joseph Sweetman Ames

AMES, JOSEPH SWEETMAN, Professor of Physics, born, Manchester Vermont, July 3, 1863, son of Dr George Lapham Ames and Elizabeth Laura (Bacon) Ames, married Mary Boykin Williams, Sept 14 1886

Educated: Shattuck School, Faribault, Minnesota, A. B 1883, Ph D 1890; John Hopkins University, L. L. D 1907, Washington College.

Professional: professor of Physics and Aviation of Physical Laboratory, John Hopkins University

Aeronautical Activities: member, National Advisory Committee for Aeronautics since its formation and chairman of its executive committee, 1920-1921 Chairman special Aviation mission in France and England, 1917

Books: "Theory of Physics", 1897; 'Manual of Experiments in Physics", 1898, "Elements of Physics", 1899, 'Free Expansion of Gases', 1898, "Prismatic and Diffraction Spectra", 1898 "Reduction of Electric Currents" (6 vols.); 1908; "Text-Book of General Physics", 1904, "The Constitution of Matter', 1913

Member: Royal Instn Great Britain, Franklin Physics Society National Academy Sciences, Am. Philos Society, Am Physics Society, Astron and Astrophys Society America

Present Occupation: Professor of Physics, John Hopkins University

Address: John Hopkins University, home, Charlesto Place, Guilford, Baltimore, Md

William E. Gillmore

GILLMORE WILLIAM E, Lt. Air Service, born, Lorain Ohio son of Quartus Gillmore and Mary J (Fitzgerald) Gillmore, married, Florence Edgren Nelson.

Educated: Public Schools, Lorain, Ohio; U S. Military Academy, West Point, N Y

Professional: All grades of U. S. Army from 2nd Lt to Colonel.

Aeronautical Activities: Served in Air Service as Executive Officer, Personnel Division; Chief, Personnel Division, Chief, Planning Division; Executive Officer, Air Service, President of Control Board, Commanding Officer of Kelly Field, San Antonio, Texas, Chief, Supply Group, Air Service

Present Occupation: Chief of Supply Group, Air Service.

Member: Army and Navy Club (Wash.), Aero Club of America, New York, N Y

Address: c/o Air Service, Munitions Bldg, Washington, D C, home 2738 Northhampton St, N W, Chevy Chase, D C.

Arthur Woods

WOODS, ARTHUR, Publicist, born, Boston, Mass., June 16, 1870, son of Joseph W Woods and Caroline Frances (Felix) Woods married, Helen Morgan Hamilton, June 16, 1916

Educated: Boston Latin School, A. B., 1892, A. M (Hon.) 1916, LL.D 1920 Harvard

Professional: Schoolmaster, Merchant, Newspaper Reporter, Lumberman, Police Commissioner, New York City

Aeronautical Activities: Chief of Personnel; Asst. Director of Military Aeronautics, Air Service

War Service: Commissioned Lt. Col. Mar 2, 1918, Colonel, Aug. 20, 1918, Overseas, Sept., Rev., Discharged Jan. 31, 1919

War Honors: Cross of St. Michael and St. George, Chevalier of the Legion of Honor

Books: "Crime Prevention," "Policeman and Public"

Member: Harvard (N. Y.) and (Boston) Racquet and Tennis, N. Y., Chevy Chase (Wash.), National Press (Wash.), Coffee House, N Y.

Address: Woolworth Bldg; home, 165 E. 74th Street, New York City

What Airmen Can Do for Meteorology

Aviators and aeronauts can be of great assistance to the Weather Bureau by making complete and accurate reports of trips and sending them to the Weather Bureau for study Such reports will supplement in a very useful way the upper air records which the Weather Bureau now regularly receives from its kite and balloon stations, and upon which are based the upper air forecasts that are furnished each to the Army and Navy Services and to others desiring them. Naturally the larger the number of reports received by the bureau, the greater will be the accuracy of the forecasts It is readily seen, therefore, that air pilots can furnish much useful data for this purpose.

The matter of the Weather Bureau co-operating with balloonists was urged by the pioneer journal *Aeronautics* in 1908, which later suggested to the bureau that they furnish the proper blanks free of charge to all those who would use them in recording their ascents. Subsequently forms were printed for distribution from the Weather Bureau at Washington.

Following will be found some general instructions for recording observations in aircraft and at the surface

The observations of pressure temperature and relative humidity should be made as nearly simultaneously as possible, at intervals of about 15 min. if the balloon is floating at nearly the same height, and as often as possible if it is rising or falling rapidly. With the temperature and the vapor pressure along the air column from the surface to the balloon, the height can be computed at leisure.

Notes on clouds should indicate their form, thickness and density; also any special changes of temperature observed in passing through the cloud layer.

Corresponding observations of pressure, temperature, relative humidity and wind should always be secured on the ground, at nearly the same moment as the observations in the balloon, these two sets of observations being always essential for any scientific discussion of meteorological data.

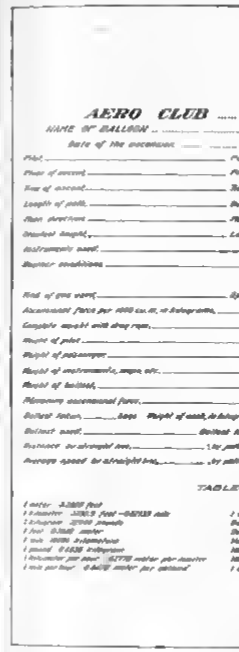


FIG 1

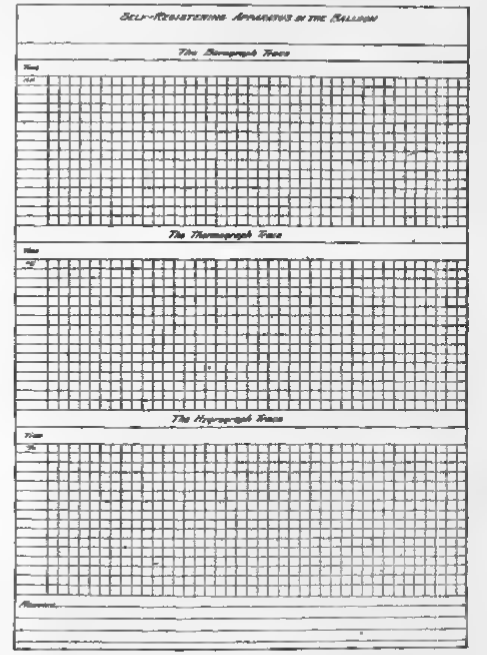


FIG. 2

In one section of the form traces of the self-registering instruments can be drawn on any convenient scale, also a small chart of the country over which the balloon has traveled should be added.

A reproduction of this form is printed herewith

In connection with this work special interest attaches to the following article by Prof Cleveland Abbe originally printed in *Aeronautics* for April, 1908 —

In an aerial voyage the aviator or aeronaut and his assistants usually have certain special objects in view that demand their full attention—but still, it is easily possible for an earnest man to make every voyage tell along the special lines in which students of the atmosphere are interested. No generous minded navigator of the ocean omits to keep a full record of wind and weather, barometer and thermometer, ocean currents and temperatures, and whatever can be considered as appertaining to navigation He does this partly for his own information, partly as the habit of a cautious man—principally because he knows that the pilot chart of the ocean that he

uses daily is compiled from thousands of such records gratuitously contributed for many years to the central national hydrographic offices at London, Paris, Hamburg and Washington where the charts were published.

Those who contribute to this observational data receive the "pilot charts" in return, or a thousandfold more than they give.

Precisely analogous arrangements should be made by aviators and aeronauts with their central meteorological offices. The students of the atmosphere who are employed in Government weather bureaus get daily reports as to conditions at the earth's surface and as to the clouds, if any are visible, and they have these many years asked for regular reports from balloons and kites as to upper air conditions—but asked in vain because this branch of meteorological work has been expensive and has only lately been developed. An air pilot is but


METEOROLOGICAL OBSERVATIONS IN BALLOONS AND AT THE SURFACE

Fig 3

helping himself when he sends copies of his records, since he is sure to receive in return items of valuable knowledge generalized from numerous other corresponding reports.

For instance, in December, 1871, the veteran aeronaut, Prof Samuel A King, who is still living and active in Philadelphia, communicated to me the records that he had saved up relative to his early voyages. From these I compiled a table and deduced a law that was at once published by the Philosophical Society of Washington, showing that in general, with scarcely a single exception, the higher he ascended so much the more did the direction of the movement of the balloon and the air deviate from that near the ground, the deviation being always toward the right and frequently amounting to a semi-circle by the time that he reached the highest current flowing eastward. Of course, such a law as this when once well established would become most important for all long voyages in North America and equally important when one has to calculate for his descent and choose a landing spot on the shore of lake or ocean. I was at that time wholly absorbed in the study of the daily weather maps and the practical forecasting of the winds and weather (telegrams and forecasts were made daily at 10 a.m., 5 p.m. and midnight). The same law had just been revealed by the comparison of these telegraphic reports of the motions of the winds, lower clouds and upper clouds, but the continuous records of balloon voyages, when the sky was cloudless, now extended this local rule into a generalization of the broadest character. Subsequently I found that Clement Ley, from cloud observations in England, had arrived at the same result and eventually I found that Henry Allan Broun had announced it at Edinburg in 1845.

The international cloud work of 1896-'97 has served to reveal the universality of the law that the upper winds deviate from the lower winds toward the right in the northern hat toward the left in the southern hemisphere.

It will be a fine contribution to our knowledge if some others following Professor King's habit of keeping careful records of voyages will show as when and why exceptions to this rule occur—as they probably do occasionally.

The records of the recent long distance competition of 1907 in which the balloon "Pommern" exceeded by a few miles the long voyage of 791 miles by John Wise in 1859, show that some of the aeronauts took advantage of this law.

In order to get a good record of the varying directions of travel the air pilot has only to keep his map at hand and mark thereon the position immediately below him as often as he can possibly identify it. But he doubles the value of his record if he also adds the minute and second (or minute and tenth of a minute if his watch has no second hand), for thus he gives the meteorologist the one datum that we can only get from free balloons, namely, the true velocity of the movement of the free air.

The heat that we get from the sun starts the atmosphere in motion. From these movements when actually known we may reason back to the heat that caused them or forward to the results that must follow. The movement of each part of the atmosphere is the fundamental need of meteorology. The chart and watch, the barograph and thermograph of the aeronaut can alone give us what we so sorely need.

Notices to Aviators

The Hydrographic Office, U. S. Navy, has instituted the publication of a monthly Notice to Aviators, the first number of which appeared under date of November 1, 1920. The object of this publication is to furnish to aviators such information as will be of assistance to them in the navigation of the air. Aviators, and others interested in air navigation, may aid in making this publication effective by forwarding to the Hydrographic Office, Washington, D. C., any information of use to airmen, and those who earnestly cooperate in this way will, upon request, be placed on the mailing list and will receive copies free of charge.

Notice to Aviators No. 1, 1920

Notice to Aviators No. 1, 1920, contains a list of landing fields in the United States and Possessions which is on file in the office of the Chief of Air Service, U. S. Army and with which aviators are generally familiar; a list of the United States naval air stations; and information concerning facilities available at landing fields in the states of New York (Brindley Field, Henry J. Damm Field, Bay Shore Field, Aqueduct Race Track Field, Central Park Field, Farmingdale Field, New York Airdrome at Copaigue, Belmont Park Field), Virginia (Dahlgren, Yorktown), Maryland (Blackistone), and in Cuba (Santa Cruz del Sur, Santiago de Cuba, Guantanamo Bay).

Notice to Aviators No. 1, 1921

Notice to Aviators No. 1, 1921 contains beside a revised list of the landing fields published on the previous notice, information on landing fields at Sagus, Mass.; Lynn, Mass., York, Me.; Kennebunkport, Me.; Old Orchard, Me.; Hampton Beach, N. H.; Springfield, Mass., Worcester, Mass., Westerly, R. I.; Narragansett Bay, R. I.; Philadelphia, Pa.; Pensacola Bay, Fla.; Mobile Bay, Ala.; Hartsell, Ala.; Atalla, Ala.; Kingston, Tenn.; Cowen, Tenn.; Lynchburg, Tenn.; Minneapolis, Minn.; Milwaukee, Wis.; Grand Rapids, Mich.; St. Louis, Mo.; Oklahoma City, Okla.; Santa Barbara, Calif.; Balboa Harbor, Calif.; Kaluhui Harbor, H. T.

A caution to American aviators crossing the Canadian border, with instructions regarding authorized crossings is appended.

Notice to Aviators No. 2, 1921

Notice to Aviators No. 2, 1921, contains information on landing fields at Troy, N. Y.; Utica, N. Y.; Lowville, N. Y.; Sylvan Beach, N. Y.; Horseshoe, N. Y.; Arcadia, Fla.; Sarasota, Fla., Oakland, Calif.; Pearl Harbor, H. T. This is followed by a note on the average weather conditions to be expected in Minnesota and by an extract from Canadian Air Regulations, 1920, Interstate Flying.

Chemical Warfare in the Air

A DH-4B equipped by the Chemical Warfare Service with gas tanks was flown on a test flight a few days ago, the object of this test being to determine the feasibility of using gas against an enemy in the air and against troops on the ground. This plane was equipped with two gases which released formed a black smoke in the flight path. It is the intention to adopt this method for camera obscura work, the assumption being that a plane cannot readily be seen against a blue sky, whereas the smoke can be seen at all times.

"Aviation" Editor's Success in Navy Competition

The Secretary of the Navy has approved the findings of the Board of Naval Officers appointed to consider designs submitted in the Navy Shipboard Airplane Design Competition.

The designs of the following competitors were accepted and are eligible for the final examinations:—Alexander Klemin, Technical Editor, Aviation and Aircraft Journal, Curtiss Aeroplane & Motor Corp., Garden City, N. Y., Dayton-Wright Airplane Co., (three designs), Dayton, Ohio., G. Elias & Bro., Inc., Buffalo, N. Y., A. L. Morse, Massachusetts Institute of Technology, Cambridge, Mass.

Under the Rules, only those competitors whose designs were accepted on preliminary examination are eligible to submit these designs for final examination. Although each competitor may present all designs which were accepted on preliminary examination, only one award can be made to each competitor on final examination. On final examination awards will be made in order of merit, the awards being of the following amounts, in the form of contracts for the non-exclusive ownership of the designs and the rights to use the same in any manner desired by the Department:—

1st merit	$10,000
2nd merit	10,000
3rd merit	5,000
4th merit	3,000

This competition, the first of its kind to be held in this country, was for the design of a special type of two-place airplane for spotting and control of gun fire of battleships at sea. For this specific naval use the present types of naval airplanes are not wholly satisfactory, while the present and projected types of Army airplanes are entirely unsuited for naval use.

The outstanding features of the type brought out under the competition are, the ability to land on water or on the deck of and aircraft carrier; and to take the air from the deck of a carrier, either with the aid of a catapult or under their own power after a run along the deck.

This competition is the first step in putting into effect the "National Aviation Policy" agreed upon between the National Advisory Committee for Aeronautics, the Army, the Navy, the Post Office Department, and other governmental departments concerned in aeronautical matters as submitted to the Congress by the President.

Rules governing the competition, which was open to all United States corporations and all citizens of the United States not in government employ, and specifications of the type of machine for which designs were desired were issued about Jan. 1, 1921. Over one hundred sets were called for and forty-two designs of thirty competitors were submitted for the preliminary examination of Feb. 15. The following submitted designs:—

Aeronautic Plane & Motor Co.	Keyport, N. J.
Bellanca, J., 1927 78th St.	Brooklyn, N. Y.
Brimm, D. J., Box 426	East Greenwich, R. I.
Cook, Alexander W.	Washington, D. C.
Cohn, Leon N. W., 206 West 109th St.	New York City
Curtiss Aeroplane & Motor Corp.	Garden City, N. Y.
Dayton-Wright Airplane Co.	Dayton, Ohio
DeFari, F.	Coytesville, N. Y.
DeMott, J. H., 299 Madison Ave.	New York City
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Hall, R. F., 702 E. State Street	Ithaca, N. Y.
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Hooton, G. B., 1003 E. Huron St.	Ann Arbor, Mich.
Huff-Daland & Co., Inc.	Ogdensburg, N. Y.
Huntington, D. W., 23 Stowe Place	Hempstead, N. Y.
Klemin, Alexander, 22 East 17th St.	New York City
Loughead, A. H., 1 N. Salsna St.	Santa Barbara, Cal.
Martin, J. V., 1007 13th St., N. W.	Washington, D. C.
Morse, A. L., Massachusetts Institute of Technology	Cambridge, Mass.
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Rooney, John, 11 East 38th St.	New York City
Shields, H. B., 32 Independence Ave.	Freeport, N. Y.
St. George, J. Maximilan, Suite 525, 108 S. La Salle St.	Chicago, Ill.
Thomas, R. D., 22 Weston Street	Waltham, Mass
Van Muffling & Marx, 299 Madison Ave.	New York City
Warner, E. P., Mass. Inst. of Technology	Cambridge, Mass.
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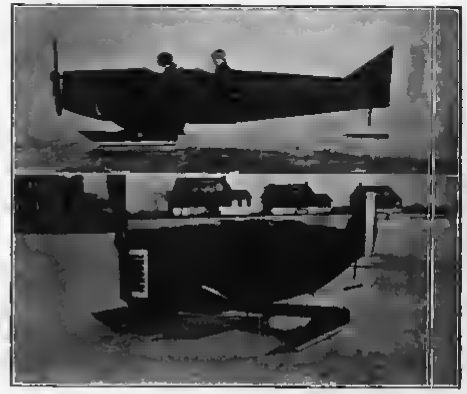
In order to avoid necessary expense to unsuccessful competitors, only such drawings and information necessary to judge whether the further development of the designs would be of advantage to the Navy was required.

The competition has given an opportunity to American aircraft designers to show what they can do toward meeting one of the problems of Naval Aviation, and the Navy Department is much gratified by the interest shown by the competitors.

Air Sleds

Aviation and Aircraft Journal is in receipt of several pictures of air sleds as a result of its statement that the air sled illustrated in the issue for Feb 21, 1921, represented a new development.

The air sled shown herewith has been successfully operated on Lake St. Clair for the past two winters. The machine is steered by a rear runner and an air rudder, both of which are operated by a foot bar. The speed is about 80 m.p.h. The machine was designed by E. J. Andries, of Detroit.



Two Views of the Andries Air Sled

The 1921 Pulitzer Trophy Race

The Contest Committee of the Detroit Aviation Society, under whose direction the next Pulitzer Trophy race will be held at Selfridge Field, Mt. Clemens, Mich., on Sept. 15, 16 and 17, 1921, have made a preliminary draft of the rules and regulations for this and other races to be held at the Aerial Contest. The Committee consists of C. F. Ketterng, H. M. Crane, Glen L. Martin, Grover C. Loening, Wm. B. Stout, Wm. E. Scripps, J. G. Vincent and S. D. Waldon, Chairman. The Committee has sent out the proposed rules for suggestions and hopes to have the final regulations ready for issue in a short time.

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HD-4 TYPE XIV ARMY TRAINING PLANE

Our airplanes are produced by men experienced in the design and construction of commercial and war time aircraft of all types.

T. H. Huff was among the first trained aeronautical engineers at Massachusetts Institute of Technology. During the war he was chief engineer and designer of the Standard Aero Corporation, designing and building the first mail plane and many types of military planes.

WE HAVE BUILT THE FOLLOWING TYPES FOR U. S. ARMY AND OTHERS

Type	Weight Full Load	Useful Load	Motor	Lbs. per H.P.	Lbs. per sq. ft.	Selling price without motor	Selling price with motor
HD-1	1940	3 seats 740 lbs.	8 cyl. Lawrance	16.0	5.8	$4,000	$9,000
HD-1A	2260	3 seats 740 lbs.	9 cyl. Le Rhone	14.1	6.3	$4,000	*Note
HD-1B	2850	5 seats 1100 lbs.	10 cyl. Aeromarine	14.1	6.5	$4,500	$5,700
HD-4	1940	2 seats 740 lbs.	7 cyl. Wasp A or Lawrance	13.9	5.8	$4,200	*Note
HD-4B	1940	2 or 3 seats 740 lbs.	10 cyl. Aeromarine	19.4	5.8	$4,200	$4,800.

*Note Motors to be purchased by customer

E. Daland was also trained as an aeronautical engineer at Massachusetts Institute of Technology and was designer in the engineering department of the Standard Aero Corporation.

L. G. Randall was general manager of the Standard Aero Corporation and produced over 1,500 airplanes during the war.

The shop force is composed of expert workmen who have had long experience in aircraft construction.

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HUFF, DALAND AIRPLANES COMPANY, INC.

OGDENSBURG, NEW YORK

Commercial Aviation in Germany *

By W. Wronsky

The D.L.R. (German Aerial Navigation Co.) was established in 1917 in order to study the question of civil aerial transport in all its phases. At that time, when the world-war was at the height of its fury and tumult, and tens of thousands of airplanes were plunged in the thick of the fight on all the Fronts, the investigation of aerial transport—which will form a link between different nations—was certainly a far-seeing project.

The unfortunate termination of the war altered the even tenor of the work. No time could be lost if anything were to be rescued from the general smash for civil aviation; rapid action and continuous energy were called for if civil aviation were destined to be a factor—even though a small one— in the scheme of economical reconstruction. Ever since the end of January, 1919, the D. L. R. possessed an extensive aerodrome with mail and giant airplanes, and an adequate number of pilots and observers.

The Early Beginnings

The much-desired opportunity was presented by the opening of the National Congress. Preliminary negotiations with the Government postal authorities easily led to a favorable understanding, and a regular aerial postal service was established between Weimar and Berlin on Feb 5. The results obtained were so encouraging from an aero-technical viewpoint, and the new means of transit met with such high approval on the part of the public, the postal authorities and the press that a second aerial postal line was opened to Hamburg in March 1919. In April, these lines were extended by further services between Berlin, Hanover, the Rhine Provinces, Berlin and Warnemunde. The Aerial Naval Station of the D.P.L. at Warnemunde also resumed work, for the time being only in special flight. The following summer, mail services (summer resort services) were established to Swinemunde and Westerland, and the entire mail was delivered by airplane in various regions when railway traffic was suspended. Beside these numerous special flight, special mention should be made of an aerial service to Ukraine, organized on behalf of the Government.

It was quite evident to the D.L.R., from the outset, that all these undertakings were to be looked upon as mere tests, carried out first and foremost with a view to convincing the public—hitherto extremely sceptical about such undertakings —that in this case it was "getting on." And it did get on. The figure of safety attained during the whole service was 95 per cent to 98 per cent, which exceeded the most optimistic expectations.

But there were many preliminaries to be gone through until a general agreement enabled us to make our first special flight over the frontiers of Germany and we thereby climbed another step on the ladder.

The North-West European Flight

When the North-West European flight was undertaken this year,—the line that links up five countries and along which our airplanes fly side by side with those of other countries, over Sweden, Denmark and Germany to Holland—few people who read the simple red posters had any idea of the work that had paved the way for the new enterprise. It has here crowned with success, however, and the first step has been taken along the high road.

The night passenger can now settle into his sleeping-car at Stockholm with his flight pass for London in his pocket, and when he awakes at Malmo in the morning and rubs his sleepy eyes, he sees his airplane in readiness on the quay; the afternoon of the same day may see him wandering through the old-world streets of Amsterdam. The Londoner posting a letter to a business friend at Copenhagen knows that it will be handed to the recipient on the following day; and our airplanes have several times carried more than one-tenth of the entire Scandinavian mail over to Germany.

A step has thus been taken forward, but though it is only a step, no prophet is needed to foretell that aerial transport is bound to develop with a rush, and in ever increasing proportions, during the next few years.

Aerial transport is nothing more or less than a universal medium of communication by air, which can only be based, in all parts of the world, on solidarity, mutual confidence and mutual aid. The first step has already been taken in the right direction. About a year and a half ago, the D.L.R. formed an aerial transport association with the leading aerial companies of Sweden, Norway, Denmark, Holland and England, known as the International Air Traffic Association (Iata). The first result of this association was the North-West European flight previously mentioned, and other plans will be followed up in common.

The airplane will also assert its rights as a means of communication in the most frequented parts of Europe. The utilization of the speed of the airplane, and the substitution of transport planes of improved construction for existing types are all that is needed to bring the whole of Europe within the scope of a day's journey from Germany.

The next thing to be undertaken will be the replacement of airplanes developed during the war, by modern transport airplanes, which will give better results in respect of speed and economy and will also render the highest possible degree of safety in working. And here again, difficulties arise and must be overcome. The number of transport airplanes utilized as a year, in Germany, will probably amount only to about one-tenth or one-twentieth of the former monthly figure of some 2000 machines at the outset. For this very reason, the construction of transport airplanes should be undertaken by none but the most efficient of firms.

It does not seem to be of advantage to fix on any particular type. Aerial transport is so many-sided that it calls for as much latitude as possible as regards type, though this does not exclude the possibility of close cooperation between the different parties concerned in making such machines, with a view to attaining greater economical success. Safety in working depends upon the engines and there is no doubt but that our technicians will make considerable headway as that branch. The comfort of the passengers must also be considered, as it is important that their capacity for work should not be diminished after an aerial journey of several hours, through fatigue.

Solution of Night Flying Essential

Flight by night and in fogs will also be facilitated in the near future, and this point is essential to enable us to compete with night trains. A systematic ground organization will here be necessary to light up the routes with flares, shipping line methods might serve as a model in this case. More difficulty is to be expected from the economical than from the technical side of the question.

It is a well-known fact that all aerial traffic companies have as yet been working at a heavy loss. In certain countries as, for instance, France and Germany, these losses were somewhat diminished by Government subsidies. In other countries, an effort was made to obtain assistance through prizes in money. The subvention system is unsatisfactory, and it can only be regarded as a transition stage. A reduction of expenditure must be achieved by the use of more economical machines, and by organization extending to the smallest details. At the same time, the receipts must be increased by judicious propagation of the idea of traveling by air.

The economical question is a particularly difficult one owing to the fact of its being scarcely possible to make any exact calculation beforehand; there are certain items in the account of expenditures that cannot be definitely fixed. Such are, for instance, the length of existence of the airplane, the rates of insurance, the consumption and cost of fuel,—all of which are subject to variation.

The question of economical usage depends chiefly on the choice of suitable machines. A survey of existing technical conditions opens up the prospect of the possibility of improvement in this respect, as may be seen by the following data:

Five Hours' Flight

Present Day Mail Airplane, 200 hp.

1918—1920 250 liters of fuel were needed for every 100 kg useful load, and a distance of 650 km. was covered at a cost of 1500 M. (130 km/h) A freight of 150 kg. could be transported.

Modern Transport Airplane, 185 hp.

1921—56 liters of fuel are needed per 100 kg useful load, and a distance of 800 km. is covered for 336 Marks. (160 km/h). A freight of 400 kg can be transported.

Giant Airplane with Four Engines of 185 hp.

1922—50 liters needed per 100 kg useful load, a distance of 1100 km. will be covered for 300 Marks, 1800 kg freight can be transported.

The above table shows that the airplanes formerly used in our transport service consumed five times as much fuel as an up-to-date airplane, constructed for transport.

It is also most important for economical working results to be obtained by the favorable and accurate disposition of the crew, upon which the possibility of attaining the highest possible efficiency is dependent, both for the airplane and the crew.

The question of increased receipts is probably the most difficult to be met—such receipts are the joint outcome of the transport of mails, parcels, goods and passengers.

The postal service has now been regulated by an agreement with the postal authorities, whereby the transport of a certain quantity of mail is obligated in return for the payment of a tax per kilometer. In the case of goods and passengers, the comparatively high tariffs charged on account of the high cost of living have done a good deal toward frightening people. The day is bound to come when we shall manage to have greater traffic at somewhat lower fares.

The greatest attraction of all will always lie in the working safety, the punctuality and the comfort of aerial journeys.

The list of accidents is a very low one, three cases of slight injuries, one of severe injury.

Lessons of the North-West Flight

The European-North-West Flight gives a distinct picture of the present lack of favorable economical conditions.

In the course of 304 flights a distance of 82,000 km. was traversed, and only 8,115 kg carried, whereas 45,500 kg might have been transported; or if we express it in figures of energy, 7.4 hp was expended on every kilogram transported. Had the freight room been utilized to the full, the figures would have been only 1.3 hp per kg. In the modern transport airplane, the figure of energy expended would have been only 0.3 hp.

All this clearly shows that though all has been done in the domain of civil aerial transport is certainly to be considered as a good step forward, many problems remain to be solved. And this task can only be achieved by a close collaboration on the part of all those interested in the matter.

It may be suggested that conferences should be held regularly, once or twice a year; they might be summoned by the Air Board, and their object would be that of having all questions connected with aerial traffic discussed by aeronautical experts.

Conclusion

From all that has been written above, the following main points may be summarized:

1. Aerial transport cannot possibly be carried out in Germany alone; its activities must be extended beyond the frontiers, and particularly in districts where there is a lack of communication by transport.

2. Specially constructed machines are necessary for aerial transport; safety in working is the first requirement for such airplanes, speed and economy are the next essentials.

3. The great outlay consequent on aerial transport can only be met by means of efficient undertakings founded on a strong financial basis. Unnecessary disunion should be avoided.

4. During the next few years, aerial transport will need the support of State subsidies, but it will gradually be enabled to stand on its own feet by progress in the technics of aeronautics and through the enlistment of the sympathy of the economical classes.

Junkers J.I. Monoplane Fitted with Burgess N-9 Floats and Fuel Tanks for 14 Hr. Flying. The High Speed of the Machine Is Said to Be 115 m.p.h.

The objection might possibly be raised, that "all these prospects of development are extremely good in their way, but we are not in a position, here in Germany, to devote labor and capital to a new task of this kind. There are so many more urgent things to be done that we surely ought to leave to richer countries the task of solving the problem of aerial transport."

A Well Founded Warning

There can be but one reply to such an attitude: "If we were to adopt and follow up that view, we should see, sooner or later, that we had made a grave mistake, and that we had omitted to cultivate an opportunity that can never be regained." And it is very certain that mankind, having once obtained the command of the air, will never relinquish that victory.

The airplane represents extraordinary progress in the line of transport, and it is consequently a progressive movement from an economical and industrial viewpoint. For the very reason that we are laboring under such economical oppression through the War and its after-results, we ought not to exclude ourselves from participating in the development of aerial transport.

* Translated by Paris Office, N. A. C. A. from *Der Luftweg*, Nos. 50-51 Excerpt.

Active Aero Clubs

Long lists of Aero, Aviation and Flying Clubs are published frequently, but many of them do not even answer letters addressed to them. AVIATION AND AIRCRAFT JOURNAL will be pleased to publish from time to time the names and addresses with present officers of all active aero clubs. These will be headed in the future issues, "Active Aero Clubs." Send to AVIATION AND AIRCRAFT JOURNAL the addresses and present officers of your club so that it may be known as an active club. Those marked * are affiliated with the Aero Club of America.

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Club Aviation Field is located at Bridgeton, Mo., 16 miles out on the Natural Bridge Road—Northwest of St. Louis. Cross-country fliers are welcome. This field is operated without profit, and open to any and all aviators, without charge. A white cross designates the field. A. B. Lambert, formerly Major Air Service, is in active charge.

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Buffalo Aero Science Club
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*Aero Club of New England
305 Tremont Bldg., Boston, Mass.

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Aviation Club of Chicago
139 North Clark St., Chicago, Ill.

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Grand Rapids Aero Club
Grand Rapids, Mich.

President, Raymond W. Smith; Vice-Pres., Dudley E. Waters, Secretary and Treasurer, Joseph H. Martin

Scranton Aero Association
Lackawana Air Trail, Scranton, Pa.

President, J S Schlager; Vice-Pres., Otto Conrad, Treasurer, E M Kohnstamm; Secretary, J F Hoffman.

*Aero Club of Buffalo
75 Niagara St., Buffalo, N. Y.

President, John D. Larkin, Jr., 1st Vice-President, Dr Charles B. Carr, 2nd Vice-President, Ralph H. Sidway; 3rd Vice-President, W. J Conners, Jr.; Secretary and Treasurer, Paul Edson Green.

DIRECTORS

Theodore C. Knight, Frank H Goodyear, E L. Thomas, John M Satterfield.

Fire at Aberdeen Proving Ground

As a result of firing shrapnel on the Main Range at Aberdeen Proving Ground, the grass took fire and assumed dangerous proportions. The fire was swept by a strong west wind towards the Aviation Field. All available personnel was turned out to fight the flames and only conquered them as they had reached the Bomb Storage and Fuse shed. Needless to say if these buildings had been fired they would have destroyed the complete lower end of the Post. As the grass burned away, many rabbits jumped from their cover to safer places, and from the number observed there promised to be good hunting next season.

Following the fire on the Main Range by only one day, the quarters of the enlisted men of the 258th Aero Squadron burned and destroyed all the personal equipment of the men. The fire was due to defective wiring near the roof and was discovered by the First Sergeant, about 8 30 A.M. at a time when all of the personnel was on duty at the flying field, one mile away. Upon their arrival the building was practically gutted and all that could be accomplished was to confine the flames to the one barracks. Immediate arrangements were made for messing and quarters.

Atlantic Fleet Air Force

The air force of the Atlantic Fleet continues northward on the return trip from its southern cruise, making exceptional progress.

On March 1, the U. S. S. Harding and seven planes arrived at Santa Cruz del Sur, Cuba. On the same date the U. S. S. Shawnut and U. S. S. Sandpiper left Cienfuegos for Guantanamo, Cuba.

The report of these movements marks the beginning of the last leg of the great cruise of this force in Caribbean waters and back along the Central American coast. When the air boats and tenders have arrived at Guantanamo, they will have rejoined the Atlantic Fleet at its base, and their Caribbean cruise will have been completed.

Flying in the Northwest

One might think that because Oregon, Washington and Idaho are northern states that they would have long cold winters; which with the numerous mountain ranges, would discourage flying But it is on account of the mild winters and these same mountain ranges that the three northwestern states offer more opportunities to the pioneer aviators than any of the other states.

The exceptionally long fall is the best time to make extended cross-country trips, as the grain fields have all been cut and cleared. The middle of the summer is perhaps the hardest time of the year to find suitable landing fields, as the grain is just high enough to prohibit a landing, and the other fields are soft on account of being plowed up. The wheat farmer plants but half his land each year ,the other half is plowed in the

Glenn L. Martin Explaining to Samuel Reszewski, the Eight Year Old Polish Chess Marvel, the Control of a Martin Bomber

spring and kept harrowed all summer and planted in the fall One can find landing fields along the foothills where the cattle graze, but there is so much wheat grown in the northwest that one naturally thinks of grain fields when making cross-country flights.

The many mountain ranges in the west will be a great factor in bringing planes into the country for transportation purposes, a reply because one can make a jump over a mountain in a plane and save from two to twelve hours as compared to the train service.

A little difficulty is being experienced in inducing the smaller town to make landing fields, as the land is very valuable at the present time as wheat farms, but as soon as these small cities can be enlightened into the value of a flying field for their community, we will see flying fields spring up all over The larger cities have municipal fields that do them credit, and some of them are largely due to the Forest Patrol, under Col Arnold, though only in Oregon, but it is hoped to see the patrol extended all over the northwest shortly

Commercial flying will start soon between the larger cities and gradually extend to the smaller towns. The Aerial Mail should branch off from the San Francisco line at Salt Lake City, and come through to Spokane, Seattle and Portland. The wheat farmers as well as cattle and sheep men are experimenting with planes and there are some fine reports as to the uses, such as jumping from one place to another on a large ranch, locating lost cattle and sheep one man claims he paid for his plane, by locating a band of sheep his herders could not find.

Scenic rides have already been started in Portland, where passengers can see the beautiful Columbia river and gorge, and Mt. Hood in a ride of less than two hours. A trip around Mt. Rainer and over the beautiful waterways around Seattle takes about the same amount of time and can not be done in twelve hours with an automobile.

The types of planes for this country at the present time must naturally have plenty of power in order to get in and out of the many small valleys and up over the mountains, and at the same time have a fairly slow landing speed on account of the scarcity of available landing fields. Large machines that carry from ten to fifteen passengers can be used between the larger cities, but it seems advisable to start such services with smaller ships and gradually work up to the large one.

Army and Navy Air Bills

While the Army and Navy Bills did not pass Congress at the close of the Session it is improbable that they will be reduced in amounts at the next session They may even be greatly increased. The parts referring to our services follow

Air Service, Army

$23,000,000: Provided, That not to exceed $4,000,000 from this appropriation may be expended for pay and expenses of civilian employees, and not exceeding $400,000 may be expended for experimentation, conservation, and production of helium: Provided further, That not less than $5,000,000 thereof shall be expended for experimental and research work with airplanes or lighter than-air craft and their equipment: Provided further, That not less than $7,000,000 shall be expended for the production and purchase of new airplanes and their equipment, spare parts, and accessories: * * *"

Aviation, Navy

"* * * For aviation, to be expended under the direction of the Secretary of the Navy as follows: For aircraft and accessories in course of construction or manufacture on June 30, 1921, and to continue the construction of rigid dirigible, $1,440,000; for new construction, and procurement of aircraft and equipment, $6 125,750, for navigational, photographic and aerological equipment, including repairs, thereto, for use with aircraft built or landing on June 30, 1921, $49,250; for maintenance, repair, and operation of aircraft factory helium plant, air stations, fleet activities, testing laboratories, and for overhauling planes, $6,500,000, for continuing experiments and development work on all types of aircraft, $3,000,000; for draftsag, clerical, inspection, and messenger service for aircraft stations, $275,000, new construction, buildings, and improvements at air stations at a total cost not to exceed $1,339,000, as follows: Cape May, $25,000 Coco Solo, $402,000 Hampton Roads $78,000; Lakehurst, $360,000, Pearl Harbor, $210,000; Pensacola, $100,000; San Diego, $164,000; in all, $18,729,000 * * *"

Los Angeles—Salt Lake Airway

Suitable landing fields and supply bases are distributed along the Los Angeles-Salt Lake airlane to afford safe travel for the mail carrying government airplanes, according to announcement by Secretary George Harrison of the Aero Club of Los Angeles. The route for the promised transcontinental air mail service is in readiness whenever the government gives the order for the western terminal of the transcontinental service to be transferred to the more favorable southern route.

Bill Providing for Flying Fields

A bill, known as S. F. 158 which has been introduced in the Senate of Nebraska by Senators Saunders and Robbins, enables cities of 3,000 or more population to provide aviation fields.

News of the Aero Clubs

Aero Club of Massachusetts

The club headquarters is now at 16 Somerset Street, Boston, and is ready for inspection. Through the members of the Club many pieces of furniture and also a few trophies have been either loaned or given outright which make the club quarters very presentable. Through the courtesy of Mr. John Lavalle, member, two of his paintings are shown, one of ships in formation and the other a single plane among the clouds. Wednesdays is at the "at home" day and members may bring their friends to lunch and discuss aviation of the past and of the future as well Luncheon is served every day to those who desire it. Out of town guests, are welcome at the Boston Club, at 16 Somerset Street, any time that they are passing through Boston or are in town for any length of time.

As to landing fields in and around Boston, this Club is doing its utmost to bring about interest and cooperation with all representative bodies in view of obtaining a suitable site for a Municipal Landing field for this city. Mr. Nathan Hoard of the Boston Chamber of Commerce has consented to serve as Chairman of a Committee that has just been appointed by the Aero Club of Massachusetts to represent the interests of the Chamber of Commerce and the Postal Department. Other organizations that are to be consulted and be represented are the Aero Club of New England, The U S Army, U S Navy, Archie Club, Aero Club of Massachusetts, commercial aircraft companies, and other bodies are to be invited from time to time The local press is giving great help in their editorials at frequent intervals, so that this work will go on with a reasonable amount of speed and that something definitely will be accomplished in the near future.

Another feature recently tried out, is assembly dances, for Club members exclusively.

The annual banquet and election will be held April 2. The speakers and guests will be prominent men of the City and State and men who are at present high officers in the Air Service of this country.

The Aviation Ball, which has become one of the major social events in Boston will be Friday evening, April 8. This Ball is to surpass all others that the Aero Club of Massachusetts has given Secretary Leslie P Dodge and John G Hutchinson who have in the past years had charge of arrangements are acting in that capacity this year

Through the untiring efforts of President Osborn and the present Board of Directors, the Club has grown steadily and conservatively and is on a firm foundation.

New York—Albany Air Line

By means of a service to be operated by the Hudson Valley Air Line between New York and Albany, business men will be able to travel the 137 air miles between these cities in 90 minutes, transact their business and be back the same day. This compares with seven hours or more required for the round trip by train.

The new service is now being organized with Aeromarine-Navy HS2-L cabin flying boats, which accommodate five passengers. It is expected that operations will begin this spring with two of these boats.

Don M. Campbell, a former chief instructor at Scott Field, with a record of 1247 flying hours in Government service, will be in charge of maintenance and operation. The company has opened offices in the Times Building, New York and at 12 Pine Street, Albany, N. Y.

Landing Field at Moundsville, W. Va.

As a link in the chain of landing fields that must accompany the marking and charting of the airways of the United States, a lease has been arranged by which the U. S. Army Air Service gets possession of 19½ acres at Moundsville, W Va., where a landing field will be established on the recently opened Washington-Dayton air route. The tract, which extends north and south 2,125 ft. and east and west 400 ft. is Ohio River bottom land at present in cultivation. Its conversion into a model landing field will begin at once.

Pioneer Low Pressure Manometer

A low pressure manometer, designed primarily for use in measuring gas pressure in kite balloons and airships has been developed by the Pioneer Instrument Co. It is intended to replace the hand gauges previously used for this purpose.

In the design of such a gauge the foremost factors to be considered were the small pressures to be indicated, the need for an adjustable "zero", the limited instrument board space available, the ruggedness of construction necessary to withstand severe service conditions, and the desirability of light weight.

The instrument as finally produced is shown in the accompanying photograph. Full indication is given for a pressure of 3 in. of water, on a scale 4 in. long; so that in addition to the greater ease and accuracy of reading as compared with a liquid manometer, the graduation is considerably magnified. From 0.5 in to 1.5 in., where greatest sensitiveness is desired, the scale is one and one-half times the size of the corresponding water column. As will be seen from the illustration, the scale is graduated in millimeters as well as in inches. The mechanism is of a new diaphragm type developed by Mr Titterington, chief engineer of the Pioneer Instrument Co.

Pioneer Manometer for Airships

By removing the screw shown at the bottom of the scale, a zero adjustment is reached. The hand can in this way be set off of zero by the amount necessary to correct for the difference in elevation between the gauge and the point in the envelope at which the pressure is to be indicated.

So that the amount of space occupied by the indicator may be minimized, a vertical scale is used. It is thus possible to place three or four manometers side by side in the space which would be occupied by a single gauge using a round indicating dial.

By careful balancing of all moving parts the bad effects of vibration and rough handling have been minimized; and an unusually rugged construction for such a delicate mechanism makes the gauge practical for use under the most severe conditions. The weight of the instrument is only 12 oz.

The Pioneer manometer is now being tested by the Lighter-than-Air branches of both the Army and Navy, and its adoption by both services is anticipated.

Chief of Air Service Inspects Kelly Field

Maj. Gen. Charles T Menoher, in his tour of inspection through Air Service activities of the Eighth Corps Area recently inspected Kelly Field. All planes in commission were lined up in review formation, parallel to and facing the hangars at a distance of 135 feet from the south wall. The crew of each plane was three paces in front of the center of the plane

A flight formation was arranged by the Pursuit and Bombardment Groups which presented a spectacular exhibition in the air; acrobatics were performed by the Pursuit planes and all the fliers on this occasion showed a great deal of ability and efficiency.

From Lincoln, Neb., to Mexico City

A long cross-country flight which did not receive the credit it deserved from the daily press was that made toward the end of last year by two Lincoln Standard airplanes from Lincoln, Neb., to Mexico City and to Tampico. All the total distance flown on the journey was over 5,300 miles, the importance of the effort may be appreciated.

The following is an excerpt from a report on this flight which Lloyd A. Winship, in charge of the expedition, made to the American consulate in Mexico City:—

REPORT TO AMERICAN CONSULATE

Trip made by two Lincoln Standard airplanes, one "Tourabout" and one "Speedster", manufactured by the Nebraska Aircraft Corp of Lincoln Neb. Flight undertaken at the invitation of President De La Huerta, General Obregon and the Mexican War Office for the purpose of experimentation and exploration.

The director in charge, riding as observer, Lloyd A. Winship. Pilots Edward (Turk) Gardner and George Puffles, chief pilot of the Mexican National School of Aviation, 1914-1916. Motors in charge of A Craft Substitute observers; Harry J. Lawson, Mrs. L. A. Winship

Route as follows: Lincoln Nebraska to El Paso, via. Junction City Kansas, Tucumcari New Mexico and Oro Grande New Mexico Time 11 hours. El Paso to Chihuahua, Torreon, Monterey, Saltillo San Louis Potosi, Qnertaro and Mexico City. Time 13 hr and 30 min. Maximum flying altitude 16,000 ft. Side trips made inland from Chihuahua, Torreon, Monterey and Saltillo, carrying as passengers and guests governors, military chiefs, mayors of cities and newspaper men. At Mexico City, complimentary rides were given to members of the cabinet, staff officers and military leaders.

In December at the National Aviation Field, we gave an exhibition as a benefit for the Mexican Red Cross, the proceeds going entirely to that organization.

The pioneer trip from Mexico City to Tampico we made on the 1st day of January 1921 at the suggestion of the Secretary of Communications. Leaving Mexico City we flew due north passing Pachuca to our right continuing due north for about 60 miles flying at an altitude of 16,000 ft., turning eastward after passing the last mountain peaks, striking the coast at Tuxpan, thence without landing passing over the oil fields and landing in Tampico. Time 2 hours and 45 min Distance 260 miles.

Return trip; Tampico to Dolores Hidalgo 210 miles. Time 1 hr and 50 min. Dolores Hidalgo to Mexico City 200 miles Time 2 hr and 10 min., flying at an altitude of 17,000 ft

Total trip, Lincoln, Mexico City, Tampico and return 2910 miles. Flying time 30 hr and 45 min. Side trips 2400 miles. Total travel since leaving the factory 5310 miles. Total flight since leaving El Paso over unexplored mountainous territory without landing fields 4300 miles without changing propeller or other repairs.

Figures given herein can be verified by reference to the Mexican War Office and The Department of Communications.

The laws of Mexico do not allow the private ownership of planes or their operation. This will have to be overcome and much work will need be done in preparing fields and training pilots for mountain travel before aeronautics can become practical in Mexico

There are representatives here to our knowledge, of three German airplane firms, two English and one French, but they have brought in no planes and have been able to accomplish nothing It might be interesting for you to know that the people representing the all metal Junkers plane have now wrecked two planes in an effort to duplicate our trip to Mexico City.

Throughout the trip we have been guests of the War Department and Department of Communications. Have met with the heartiest reception and co-operation on the part of the citizens everwhere We have been surprised to note by our own personal observation even in the small towns far away from the railroads where few, if any, Americans travel, in the general treatment given us during the entire length of the trip, the utter lack of the so called Anti-American feeling, which we were led to believe in the United States was prevalent in Mexico. As further proof of the friendship for America, we found upon arrival in Mexico City, that the closest friends of the Administration were Americans.

It is my own opinion formed by personal conversation with President Obregon and by counsel with many of his friends that the President personally has the highest regard for America and things American, and is sincerely anxious that the American business endeavors should have every fair opportunity for developing in the Republic. Among the members of the Cabinet and the Governors of the various States, with whom we have had the honor of forming a rather close acquaintance America has many sincere friends who are giving much thought to the establishing of materially helpful relations between the two Republics.

Parachute Saves Mail Pilot

For the first time in the history of aviation in this country an emergency escape has been made from a disabled airplane through the means of a life pack or parachute. C. C. Eversole, veteran pilot of the Air Mail Service, used this means to leave his ship after it had got entirely out of control and went into a nose dive. He probably owes his life to this fact.

The accident occurred a few miles outside of Minneapolis, Feb 18, on the pilot's regular trip to Chicago, while traveling at an altitude of 2500 ft. Officials at the mail field questioned the necessity of Eversole resorting to the use of the parachute. Some went so far as to intimate the pilot had resorted to this means of escape purely for the publicity that would result, although three fatal accidents had occurred in the immediate vicinity in which all of the fliers might have been saved had they been provided with parachutes. It was further rumored that the life pack used was of Eversole's own manufacture and that he took advantage of this instance to demonstrate its practicability On being interviewed, Pilot Eversole stated that the pack used by him was one manufactured by the Floyd Smith Co., in general use by the Air Mail Service and issued to him by officials at the Chicago station.

All chance of proving the true cause of the accident by any evidences which might have remained in the wreckage after the crash of the plane was destroyed when officials of the Minneapolis field followed their usual custom of burning the wreckage after removing the mail. In an interview he gave in Chicago, where the pilot stopped on his way to Washington to make a full report of his experience, Eversole gave the following story:—

"I am ordered to Washington to make a full report of just what happened in the accident that occurred when I was out of Minneapolis a few miles on my way to Chicago I was driving a twin De Haviland plane had the first evidence of trouble developed in the right motor when I had reached an altitude of 2500 ft The vibration became so excessive it changed the ship's alignment to such a degree that it was thrown entirely out of control At first the ship dropped into a nose dive and then nosed up and then took another dive, always with the left wing low, defying all my efforts to get it up None of the controls seemed to have any effect. I raised up and sat on the cowl, pushed the wheel against the cowl but it did not bring it out of the dive and I then decided to use the parachute I got out on the side of the fuselage but the sight of the far distant ground made me try to regain control of the ship once more. The ship nosed up once again to a stalling angle which the controls would not stop and then dropped the left wing more than before, the nose following for one turn of a spin This discouraged further attempts to regain control and as I had stayed until the ship lost about 1,500 ft. altitude, I dropped off. After feeling sure the ship was clear away from me, I pulled the release ring. What made the greatest impression with me was when I heard and saw the terrific crash of the ship and then realized how nicely I was floating down.

"The recent deaths in this division caused me to mention the value of parachutes to field officials. I was informed a parachute was available for any pilot that wanted one at the Maywood field in Chicago When I was reassigned to the north end of the St. Louis-Twin Cities route I asked for a parachute and a life pack marked F. S. A. E Co was assigned to me. I do not hesitate to say to you that it is my first belief I would not be here today if I had not seen fit to use it."

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THE AIRCRAFT SERVICE DIRECTORY

Where to Procure Equipment and Services

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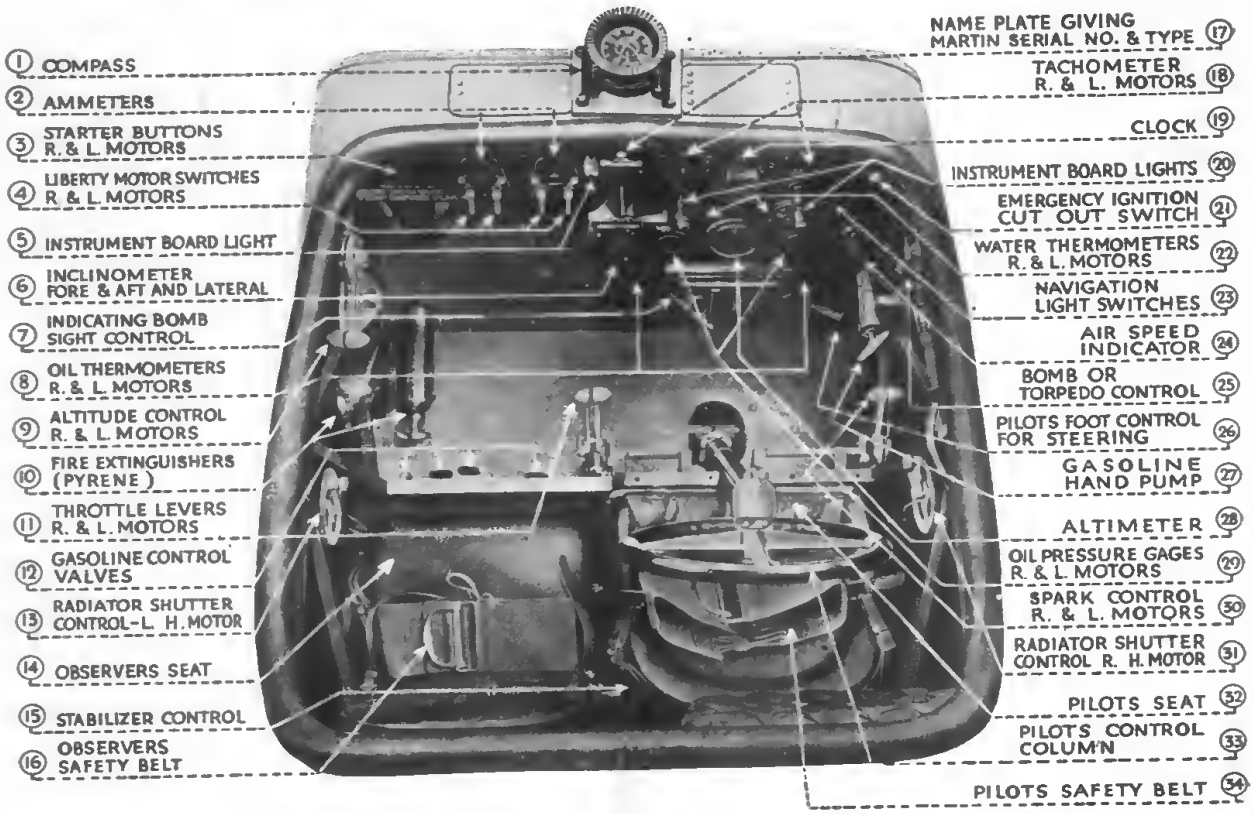
In the Pilot's Cockpit



HERE is the center of control of an 800 H. P. Glenn L. Martin Airplane. This cockpit is roomy enough to provide comfortable quarters for two good sized men clad in heavy fur-lined flying suits.

There is ample space for the use of maps and charts, and the whole installation is specifically designed to give the pilot direct and easy manipulation of all engine and flight controls regardless of his heavy fur-lined gloves. It's as complete as the kitchen of a dining-car - as free of action as the control of an automobile.

All instruments and controls are plainly labelled, those to which constant reference is made are self luminous and all controls are lettered to show at a glance whether they are "on" or "off," "open" or "closed."

Because this cockpit is at once, wheel house; chart room, engine room, and because upon its completeness depends the safety of navigation in four dimensions, there is nothing in ocean liner, railway engine; or automobile to compare with it. It represents the last word in scientific control, and is; in its completeness, characteristic of the thoroughness and integrity which mark the entire structure of a Glenn L. Martin plane.

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